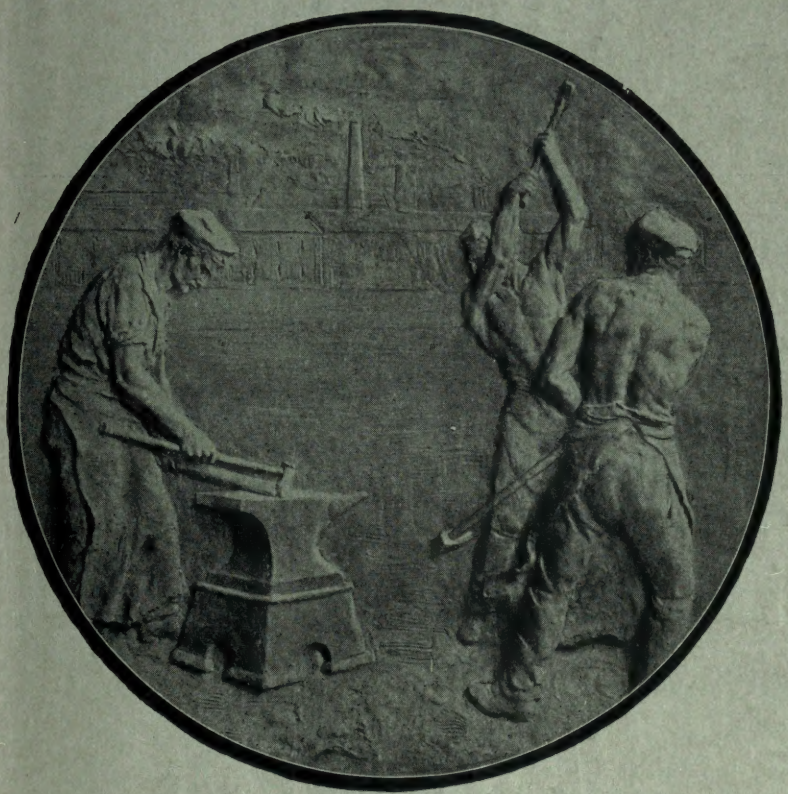
PAGE'S WEEKLY.—March 24, 1905. This Paper Copy for Circulation Abroad.

No. 28. Vol. 6. SIXPENCE. (Registered as a Newspaper.) FRIDAY, MARCH 24, 1905.

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# PAGE'S WEEKLY



## ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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# HADFIELD'S STEEL FOUNDRY Co., LTD. SHEFFIELD.

Tramway
Points and Crossings,
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Hadfield's Patent
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These two pairs of Hadfield's Tramway Wheels and Axles have been in use on the Sheffield Corporation Tramways for a period of 2½ years on routes of difficult and steep gradients, and during that time have travelled a distance of 79,680 miles. The wheels have worn equal in diameter, and have never been returned or removed from service during this time.

Wheels and Axle before being put to work, shown for comparison.

# MALLEABLE IRON CASTINGS.

## The Hardy Patent Pick Company, LIMITED.

SHEFFIELD, ENGLAND.

PAGE'S WEEKLY

# Miscellaneous


## Mr. G. H. HUGHES, M.I.Mech.E.,

**Consulting and Organising Engineer for Water Works and Industrial Undertakings,**

**97, QUEEN VICTORIA ST., LONDON, E.C.**

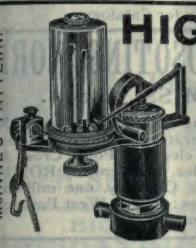
Telephone No.: 5754 Bank. Write for particulars.

## PAGE & ROWLINGSON,

**Chartered Patent Agents.**

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

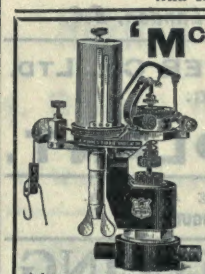
**28, NEW BRIDGE STREET, LONDON, E.C.,**
And 14, St. Ann's Square, Manchester.




## HIGH SPEED INDICATORS

**Hannan & Buchanan,**
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
**Engineering Instrument Makers**





## 'McINNES-DOBBIE' INDICATORS.

**In Two types: External and Enclosed Pressure Springs.**
Each made in several forms and sizes to suit all speeds and pressures.
**Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.**

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Adopted by the British, French, and Japanese Admiralties. **45, BOTHWELL ST., GLASGOW.**

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

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**Water stored where most convenient under pressure and automatically distributed.**

**For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.**
**Descriptive Circular sent on request.**

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Licensee, Sole Agent, and Manufacturer for the United Kingdom and Colonies.

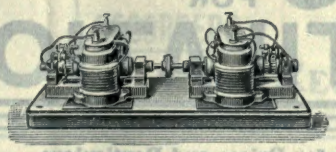
## BABCOCK & WILCOX, Ltd.

**PATENT WATER-TUBE BOILERS.**

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.
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**HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.**
**WORKS—Renfrew, SCOTLAND.**

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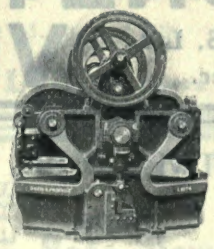



## THE CRYPTO ELECTRICAL CO.,

Telephone: 12830 CENTRAL.
3, Tyers Gateway,
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## DESTRUCTORS and CLINKER MACHINERY.

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Telegrams: "DESTRUCTOR." Telephone: 2006.
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## ENGINEERING PHOTOGRAPHY

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BOOKER & SULLIVAN,
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LONDON, W.C.

PAGE'S WEEKLY

# Miscellaneous


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**Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.**

*ZEITZ & Co., 21, Lime St., London, E.C.*

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Write for Section Lists and Prices.

Telegrams: "LEGATION, LEEDS."

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CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

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See our Advertisement appearing April 14th.

**TEMPERLEY TRANSPORTER CO.,**
72, Bishopsgate Street Within, LONDON, E.C.

Telephone: 365 London Wall. Telegrams: "Transumo."

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VERTICAL STEAM BOILERS

Apply for Catalogue.

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Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, iss.—Address, JNO. B. LINDSEY, Superintendent.

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FOR RAISING SEWAGE, SLUDGE, WATER, &c.
**Air Compressing Machinery**
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**Speciality: TRAMRAILS.**

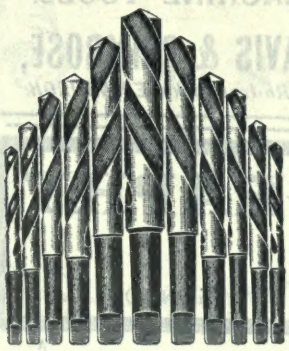
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MATTHEWS & YATES, Ltd.,
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Twist Drills,
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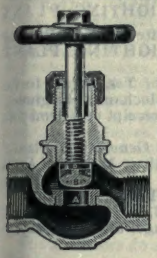
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**NEW "STANDARD" MACHINES.**
They will interest you.

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BEST MATERIAL, WORKMANSHIP, AND DESIGN.

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# PAGE'S WEEKLY — Miscellaneous

## The "SHAW" Patent Steam Valves . .



**With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.**

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

**Try Them!** Sent on Approval.

*Write for particulars of these and other Specialities for High Pressure Steam.*

JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD.

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**LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.**
(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

**RELIANCE LUBRICATING OIL CO.,**
19 & 20, Water Lane, Great Tower Street.
**LONDON, E.C.**
Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

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## ED. BRAND,

*MECHANICAL ENGINEER,*
**35, SHAKESPEARE STREET, MANCHESTER.**

**Modern Wire-Working Machinery,**
Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.

Inquiries Solicited. Teleg. Address: "Filieres, Manchester."

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## FORTUNES IN WASTE FIREWOOD AND LIGHTER MACHINERY

**M. GLOVER & CO., Patentees, LEEDS.**

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# Refuse Destructors.

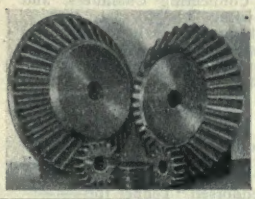
***Write for particulars to:—***

## HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

**Works: MANCHESTER and WORCESTER.**

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## Rawhide Gears

**A SPECIALITY.**
Also all kinds of Metal Gearing.

**AD. AHLERS,**
Whitley Bay, Newcastle-on-Tyne.

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## STONE BREAKERS,

**GRAVEL WASHERS, ETC.**

**SAMUEL PEGG & SONS, Engineers,**
***LEICESTER, England.***

SEND FOR ILLUSTRATED CATALOGUE.

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HIGH-CLASS
*NEW MACHINE TOOLS*
**IN STOCK FOR IMMEDIATE DELIVERY.**

## THOS. W. WARD, LIMITED,

Send for Catalogue (post free).

*ALBION WORKS,*
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Rochester Card
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} **RECORDERS.**

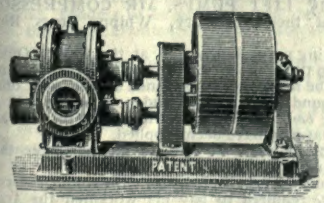
For further particulars . . of our . . see our whole page Ad. on April 14th.

## TIME RECORDERS

**RECORDERS, LTD.,** 171, Queen Victoria Street, LONDON, E.C.

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## ENKE'S ROTATIVE PUMP.




Best of all Systems for all Liquids.

4,000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

## ENKE'S PRECISION BLOWER.

Entirely of Iron without packing for high pressures to 0·3 atm.

**CARL ENKE,** Schkeuditz-Leipzig, GERMANY.

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GRAB DREDGERS. OIL SEED AND CAKE MILLS. OIL REFINERIES.

## Rose, Downs & Thompson, LTD.,

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and
**12, Mark Lane, LONDON, E.C.**

WATER SOFTENING PLANT.

PAGE'S WEEKLY

# Contracts

## CONTRACTS.

### WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive TENDERS for the CONSTRUCTION of the above WORKS, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1¼ miles in length, 12in. and 15in. in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes: being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for———— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board.

24, Stow Hill, Newport, Mon.

### THE CORPORATION OF GREAT YARMOUTH.

ELECTRIC LIGHTING.

The Corporation of Great Yarmouth invite TENDERS for the SUPPLY and DELIVERY of:—

SECTION 3.—SURFACE CONDENSER, with STEAM-DRIVEN AIR and CIRCULATING PUMPS.

Copies of the specification, with general conditions and form of Tender, may be obtained at the offices of Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., upon payment of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Extra copies of the specification can be obtained upon payment of 5s. each copy (which will not be returnable).

Sealed Tenders, endorsed "Electric Lighting," must be delivered at the Town Hall, not later than 12 noon, on Wednesday, March 29th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
W. EDGAR STEPHENS,
Town Clerk.

Town Hall, Great Yarmouth,
March, 1905.

### HALSTEAD URBAN DISTRICT COUNCIL.

The above Council invite TENDERS for the SUPPLY and FIXING of an 8-Brake Horse-power OIL ENGINE and 4-in. CENTRIFUGAL PUMP.

Particulars can be obtained on application to the undersigned, to whom sealed Tenders, endorsed "Tender for Oil Engine," must be delivered on or before March 31st, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
W. A. NICHOLSON,
Surveyor.

Town Surveyor's Office,
Halstead, Essex, March 13th, 1905.

### VICTORIAN RAILWAYS. — TENDERS

are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISH-PLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the Tender Box at the Railway Offices, Melbourne, Victoria, Australia, or at the office of the Agent-General for Victoria, 142, Queen Victoria Street, London, E.C., before 1 p.m., on Monday, April 10th, 1905.

Charge for specification with drawing, 7s. 6d.

### CLYDE NAVIGATION.—TO MECHANICAL AND ELECTRICAL ENGINEERS.

ELECTRIC POWER GENERATING AND LIGHTING PLANT

The Trustees of the Clyde Navigation invite TENDERS for ELECTRIC POWER GENERATING and LIGHTING PLANT for Clydebank Dock.

Copies of the general specification, with form of Tender, are to be had at this office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £3 3s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Electric Generating Plant," to be lodged with the undersigned not later than Monday, April 10th, 1905.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.

16, Robertson Street, Glasgow,
March 10th, 1905.

### THE SECRETARY OF STATE FOR

India in Council is prepared to receive TENDERS from such persons as may be willing to supply:—

1. BEARING PLATES FOR RAILS.
2. 152-ft. SPANS FOR ROAD BRIDGE.
3. BRASS BOILER TUBES.
4. COPPER FIREBOX PLATES.
5. WHEELS AND AXLES FOR CARRIAGES AND WAGONS.
6. SPRINGS, LAMINATED.
7. SPRINGS, SPIRAL AND VOLUTE.

The conditions of contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, March 28th, 1905, for Nos. 1 to 5, and on Tuesday, the 4th April, 1905, for Nos. 6 and 7, after which times respectively no Tender will be received.

India Office, Whitehall,
March 15th, 1905.

E. GRANT BURLS,
Director-General of Stores.

### THE CONVOY WOOLLEN CO., LTD.,

CONVOY, Co. Donegal, Ireland, are prepared to receive TENDERS for a 400 Horse-power TRIPLE-EXPANSION STEAM ENGINE and a 400 Horse-power STEAM BOILER.

The specifications, which have been prepared by the Consulting Engineer, Professor JAMES LYON, M.A. Dublin, can be obtained by application to the Company on payment of Two Pounds, which will be returned on receipt of a *bonâ fide* Tender.

The Company do not bind themselves to accept the lowest or any Tender.

Tenders for either or both must be deposited with the Company on or before April 7th.

TO BOILER MAKERS AND ENGINEERS.

### THE GUARDIANS OF THE POOR OF

the NEWCASTLE-UPON-TYNE UNION invite NAMES of CONTRACTORS desirous of TENDERING for the SUPPLYING and ERECTING of BOILERS, ECONOMISERS, PUMPS, TANKS, and details in connection with the same, at the Workhouse.

Further information will be forwarded in due course by the Architects, Messrs. NEWCOMBE AND NEWCOMBE, 89, Pilgrim Street, Newcastle-upon-Tyne.

Names will be received by the undersigned up to noon on Monday, the 27th inst.

A deposit of £1 will be charged (to be returned on receipt of a *bonâ fide* Tender).

The lowest or any offer not necessarily accepted.

By order,
JAMES ATKINSON,
Union Clerk.

Union Offices,
127, Pilgrim Street, Newcastle-upon-Tyne,
March 14th, 1905.

### WEST HAM UNION.—The Guardians

invite TENDERS for the SUPPLY, DELIVERY, and FIXING of HYDRAULIC LIFT PUMPS, AIR COMPRESSOR, and CONNECTIONS, at their Infirmary, Whipps Cross Road Leytonstone, N.E.

A specification and drawing may be inspected at the Clerk's Office, at the Workhouse, between the hours of 10 a.m. and 4 p.m., and forms, upon which Tenders must be made, can be obtained at the said office on payment of a Five Pound Bank of England note, which will be returned on receipt of a *bona fide* Tender, with the return of any specification or drawing that may have been supplied.

Tenders, sealed and endorsed, must be sent to me not later than 4 p.m. on Wednesday, March 29th, 1905.

The contractor whose contract is accepted, and with whom the contract is entered into, will be required to pay his workmen the trade union rate of wages current in the district.

The Guardians do not bind themselves to accept the lowest or any Tender.

By order of the Board,
FRED. E. HILLEARY,
Clerk.

Clerk's Office, Union Workhouse,
Leytonstone, N.E., March 15th, 1905.

PAGE'S WEEKLY

# Contracts

## THE MADRAS RAILWAY COMPANY

are prepared to receive, until Twelve o'clock on Monday, March 27th, TENDERS for the SUPPLY and DELIVERY free on board, of Wrought Iron and Steel Bars, Sheets, Plates and Wire, Copper and Brass Sheets, Wire and Rivets, Zinc, Tin, Galvanised and Lead Sheets, Pig Lead, Files, Wood Screws, Nails, Chain, Vices, Picks, Shovels, Crowbars, Hammers, Wrenches, Braces, Augers, Carpenter's Tools, Door Bolts, Locks, Buckets, Copying Presses, Lamp Fittings, Cutlery, General Ironmongery, Canvas, Bunting, Wicks, Leather, Emery Cloth Brushes, Hammer Handles, Glass Sheet, Lenses, Globes and Gauge Glasses, Crockery, Fire-clay, Grindstones, Soaps, Tar, Red and White Lead, Paints, Acids, and Drysalteries, Turpentine, Varnishes, and Fog Signals, as per specifications to be seen at the Company's offices.

Tenders to be delivered in sealed envelopes addressed to the undersigned endorsed "Tenders for Stores" (Part I., II., III., or IV., as the case may be).

The Directors do not bind themselves to accept the lowest or any Tender.

A charge (which cannot be returned) will be made for each copy of the specification.

W. H. COLE,
Secretary.

1, Broad Street Place,
Finsbury Circus, London, E.C., March 6th, 1905.

## BOROUGH OF KEIGHLEY.—The Electricity Committee

is prepared to receive TENDERS for the following PLANT:—

CONTRACT No. 9.—ONE LANCASHIRE BOILER.

CONTRACT No. 10.—ONE 300 K.W. DIRECT-CURRENT STEAM DYNAMO. HIGH-SPEED ENCLOSED ENGINE.

Specifications may be obtained on or after March 6th from Mr. J. M. SMYTH, Borough Electrical Engineer, Electricity Works, on payment of One Guinea for each specification to Mr. ALFRED LISTER, Borough Treasurer, Town Hall, which fee will be returned on receipt of a *bonâ fide* Tender.

Extra copies may be had for 5s. each, which sum will not be returned.

Sealed Tenders, endorsed "Contract No. ——," and addressed to the Chairman of the Electricity Committee, Town Hall, must be delivered not later than 10 a.m. Monday, March 27th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
GEORGE BURR,
Town Clerk.

Town Hall, Keighley,
March 1st, 1905.

## COUNTY BOROUGH OF BOLTON.

COOLING TOWER AND CONDENSING APPARATUS.

The Electricity Committee of the Bolton Corporation invite TENDERS for the SUPPLY and ERECTION of COOLING TOWER and CONDENSING APPARATUS in connection with their Power Station.

Specification, Form of Tender, and full particulars may be obtained on application to Mr. ARTHUR A. DAY, A.M.I.C.E., M.I.E.E., Borough Electrical Engineer, Spa Road, Bolton.

Tenders, endorsed "Coolers and Condensers," must be delivered to the undersigned on or before March 30th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
SAMUEL PARKER,
Town Clerk (*pro tem.*).

Town Hall, Bolton,
February 24th, 1905.

## BOROUGH OF HAMMERSMITH.

ELECTRICITY DEPARTMENT.

The Hammersmith Borough Council invite TENDERS for the SUPPLY of the following:—

1. BOILER FLUES and ECONOMISERS.
2. HIGH-PRESSURE STEAM PIPES.
3. HIGH-PRESSURE FEED-WATER PIPES.
4. EXHAUST STEAM FEED-WATER HEATER and CIRCULATING WATER PIPES.
5. STEAM VALVES and FEED-WATER HEATERS, and
6. COAL ELEVATOR.

Specifications and Forms of Tender can be obtained of the Borough Electrical Engineer, Mr. G. GILBERT BELL, Electricity Works, 85, Fulham Palace Road, W., upon payment of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Sealed Tenders to be endorsed and delivered to me at the Town Hall, Broadway, Hammersmith, not later than 4 p.m. on Wednesday, April 5th, 1905.

The Council does not bind itself to accept the lowest or any Tender.

H. THOMPSON, Town Clerk.

March 14th, 1905.

## URBAN DISTRICT OF RATHMINES AND RATHGAR.

The Rathmines and Rathgar Urban District Council invite TENDERS for CONDENSING PLANT.

Specifications and form of Tender may be had on application to Mr. GEORGE F. PILDITCH, A.M.I.E.E., Electricity Works, Rathmines.

Tenders, sealed and marked "Tender for Condensing Plant," must be delivered to the undersigned on or before the 27th inst.

The Council do not bind themselves to accept the lowest or any Tender.

F. P. FAWCETT,
Clerk to the Council.

Town Hall, Rathmines, Co. Dublin,
March 6th, 1905.

## BOSTON UNION.—LAUNDRY FITTINGS, MACHINERY, ENGINE AND BOILER FOR NEW LAUNDRY AT THE WORKHOUSE, BOSTON.

The Guardians of the Poor of the Boston Union are prepared to receive TENDERS for LAUNDRY FITTINGS, MACHINERY, ENGINE and BOILER for the new Laundry proposed to be erected at the Workhouse, Boston.

Persons desirous of tendering for the above are to send in their names to the Architect, Mr. JAMES ROWELL, Church Lane, Boston, Lincolnshire, on or before March 25th, 1905.

Plans of the buildings and particulars of requirements may be inspected at the Architect's Office.

A copy of the plans of the buildings and requirements may, by arrangement with the Architect, be obtained on loan, on a deposit of £2, which sum will be returned on receipt of a *bonâ fide* Tender, &c., and the copy of plans and particulars, by time agreed.

Tenders, &c., to be sealed and endorsed "Tender for Laundry Machinery," and sent, addressed to the undersigned, not later than April 15th, 1905.

There is no undertaking to accept the lowest or any Tender, nor will any expenses be paid in connection therewith.

JOHN M. SIMPSON,
Clerk to the Guardians.

Clerk's Office,
28, Wide Bargate, Boston,
March 11th, 1905.

# APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

## THE SECRETARY OF STATE FOR

India in Council will, in the Summer of 1905, make not less than ELEVEN APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department, in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday 1st May next.

A. GODLEY,
Under Secretary of State.

India Office,
February 24th, 1905.

## COUNTY OF LONDON.—EDUCATION ACTS, 1870 to 1903.

The London County Council invites APPLICATIONS for the following APPOINTMENTS in the Education Department:—

FOUR DIVISIONAL INSPECTORS, who will have the general superintendence of large districts, and give special attention to the co-ordination of education within their areas. Their chief duties will be to inspect pupil teachers' centres, secondary schools, training colleges, science and commercial centres, polytechnics, and all institutions for higher education aided by the Council. Candidates will be required to possess special qualifications in one of the following subjects:—(1) English Language and Literature; (2) Modern Languages; (3) Mathematics and Science; (4) Technology (including Mechanical and Electrical Engineering). The salary will be in each case £600 a year, rising by annual increments of £25 to a maximum salary of £800 a year.

ONE INSPECTOR of WOOD and METAL WORK, whose chief duties will be to inspect the teaching in Wood and Metal Work in manual training centres and elementary and secondary schools. He will also be required to inspect certain classes at polytechnics. The salary will be £400 a year, rising by annual increments of £20 to a maximum salary of £500 a year.

The persons appointed will be under the control of the Chief Inspector, and will be required to give their whole time to the duties of the office, and will in other respects be subject to the usual conditions attaching to the Council's service, particulars of which are given in the form of application.

In connection with the appointments there is no restriction with regard to sex.

Applications should be made on the official form to be obtained from the Clerk of the London County Council at the County Hall, Spring Gardens, S.W., or at the Education Offices, Victoria Embankment, W.C.

The applications must be sent in not later than 10 a.m. on Saturday, the 1st day of April, 1905, addressed to the Education Offices as above, and accompanied by copies of not more than three recent testimonials.

Canvassing, either directly or indirectly, will be held to be a disqualification for appointment.

G. L. GOMME,
Clerk of the London County Council.

Spring Gardens, S.W.,
March 2nd, 1905.

## STOREKEEPER. — Wanted, Situation in

large Engineering Works, by thoroughly reliable and competent man; long experience, good stock and book-keeper; excellent references.—PROGRESSIVE, 28, Osborne Road, Sharrow, Sheffield.

# BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23, and 25.*

*In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality* ONLY.

*Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.*

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## Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

## Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

## Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

## Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

## Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

## Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

## Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

## Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

## Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

## Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

## Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

## Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

## Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

## Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

## Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

## Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

## Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

## Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

## Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

## Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

## Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

## Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

## Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

## Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

## Economisers.
E. Green & Son Ltd., Manchester.

## Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

## Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

## Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

## Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

## Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

## Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

## Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

## Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

## Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

## Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

## Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

## Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

# PAGE'S WEEKLY — Wells' Specialities




## PORTABLE LIGHT FROM OIL
### UP TO 4,000 CANDLE POWER.

**Adopted by 26 Governments and all Leading Firms. Over 17,000 sold. Over 1,500 supplied to British and Foreign Railways.**

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

| | PRICE COMPLETE. |
|---|---|
| No. 0.—500 Candles, small hand pattern, for petroleum ... ... ... | £7 7 0 |
| No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ... | £10 0 0 |
| No. 2.—1,500 or 2,000 Candles, useful and portable pattern ... ... ... | £15 10 0 |
| No. 3. 2,500 or 3,500 Candles, Manchester Ship Canal pattern ... | £16 10 0 |
| No. 4.—3,500 or 4,000 Candles. A most powerful lamp ... ... ... | £17 15 0 |

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

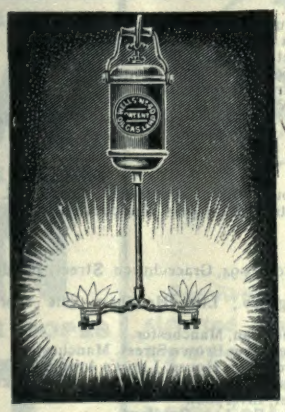
## For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.



## WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

| | |
|---|---|
| Price, with Single Burner... | 16/- each. |
| ,, Double ,, ... | 19/- ,, |
| Tripod Stands ... ... | 3/- ,, |
| Extra Burners ... ... | 2/- ,, |

# A. . WELLS & Co.,

## 100a, Midland Road, St. Pancras,

LONDON, N.W.

## WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

### PAINTING BY MACHINE.

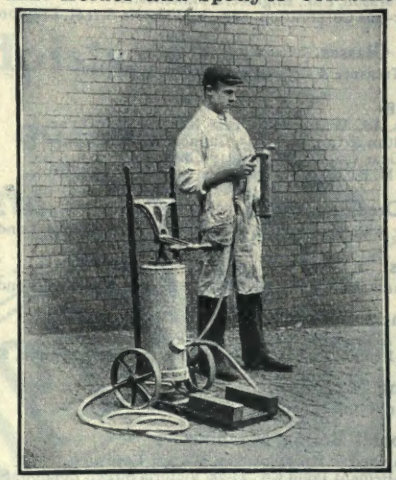
**Great Saving in Time, Paint, and Labour.**

**PAINTING SPEED—3 square yards a minute.**

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

| | |
|---|---|
| **No. 1 Painter** (as above Illustration) ... | £25 0 0 |
| **No. 2** ,, ... ... ... ... ... | £30 0 0 |
| **No. 3** ,, ... ... ... ... ... | £35 0 0 |
| **Single Air Compressor** ... ... ... | £17 10 0 |
| **Double Air Compressor** ... ... ... | £27 0 0 |

### HAND AIR COMPRESSORS, Paint Holder and Sprayer Combined.



**Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c.,**

or any class of painting where the work is not very heavy or continuous.

**Price, Complete ... ... £16.**

**Hand Sprayer and Hose** supplied separately, **£9.**

Supplied to **12** Governments, principal Railways, and leading Firms in Great Britain.

### VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.

No. 2 Painter, extra £30.




**OVER 500 PLANTS SOLD.**

# Buyers' Directory—(*Continued*).

### Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

### Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

### Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

### Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

### Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

### Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

### Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

### Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

### Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

### Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London S.E.

### Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

### Hoisting Machinery.
*See* Conveying Machinery.

### Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

### Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

### Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

### Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

### Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

### Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

### Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

### Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

### Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

### Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

### Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

### Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

### Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

### Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

### Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

### Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

### Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

### Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

### Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

### Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

### Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

### Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

### Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

### Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

B WIRE ROPES
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# STEEL WIRE ROPES

## AND APPLIANCES.

**FLEXIBLE STEEL WIRE ROPES**

FOR

**Cranes, Lifts, Hoists, Etc.**

**ABSOLUTELY RELIABLE.**
**ONLY ONE UNIFORM QUALITY.**

**Blocks, Pulleys,**
**Crab Winches, Tackle, Etc.**

MINING & HAULING PLANT.

*Illustrated Pamphlets may be obtained on Application.*

AERIAL ROPEWAYS



Ropeways constructed **on all systems** to convey from 50 to 2,000 tons per day. Suitable for the transport of materials of all descriptions.

Regd. Offices: 72, MARK LANE. Telephone: No. 2110 Avenue.

**BULLIVANT & CO., Ltd.,**

LONDON, ENGLAND.

Works: MILLWALL, E.

# Buyers' Directory—(*Continued*).

### Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

### Photographers.
Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

### Photographic Apparatus.
Marion & Co., Ltd., 22, 23, Soho Square, London, W.

### Pinch Bars.
Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

### Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

### Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

### Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

### Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

### Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

### Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

### Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

### Radial Drilling Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

### Rails.
Wm. Firth, Ltd., Leeds.

### Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

### Riveted Work.
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

### Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

### Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

### Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

### Spanners.
Williams, J. H. & Co., Brooklyn, New York, U.S.A.

### Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

### Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

### Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

### Steam Traps.
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Lancaster & Tonge, Ltd., Pendleton, Manchester.

### Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

### Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

### Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

### Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

### Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

### Time Recorders.
Howard Bros., 10, St. George's Crescent, Liverpool, and 100c. Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

### Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

### Turbines.
G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

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Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

### Valves.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Wian, Charles, & Co., St. Thomas Works, Birmingham.

### Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

### Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

### Water Softeners.
Lassen & Hjort, 52, Queen Victoria Street London, E.C.

### Weighing Apparatus.
W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

### Wells Light.
A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

### Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

### Wire Working Machinery.
Ed. Brand, 35, Shakespeare Street, Manchester.

### "Woodite."
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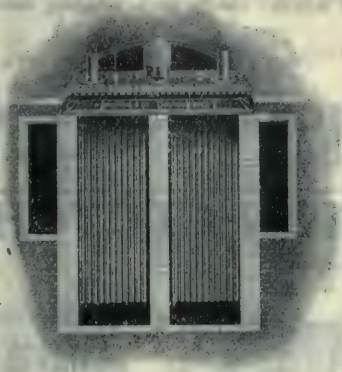
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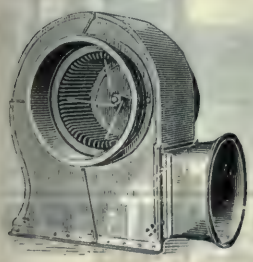
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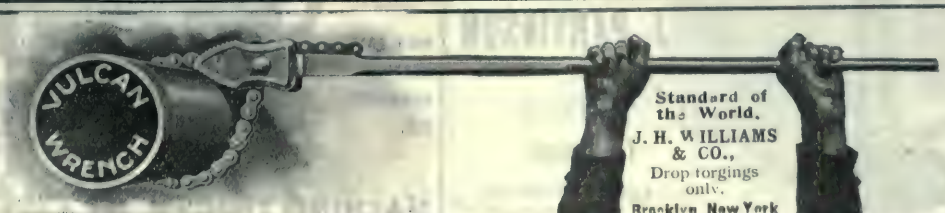
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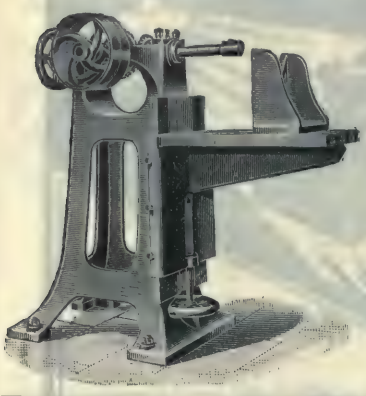
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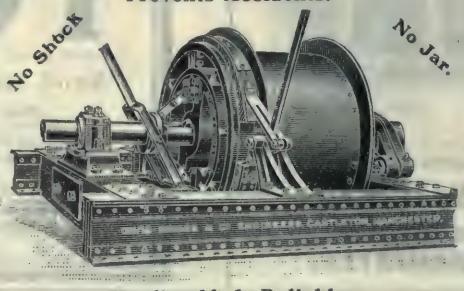
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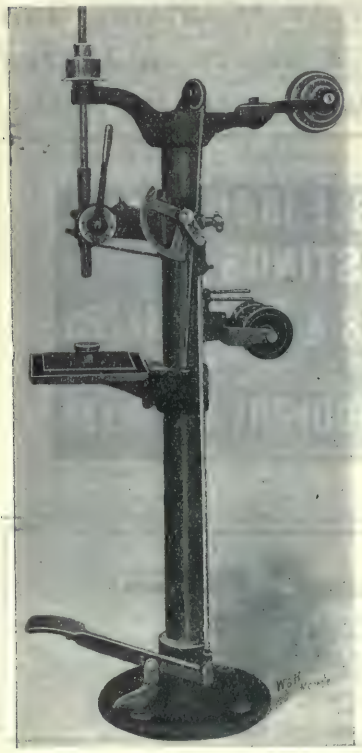
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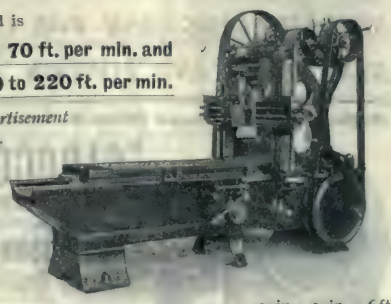
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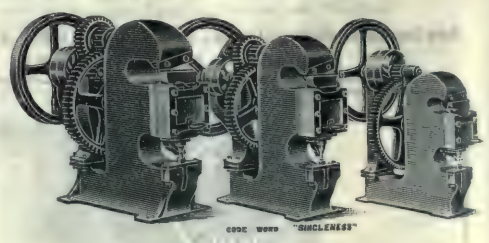
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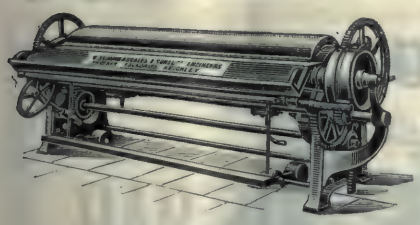
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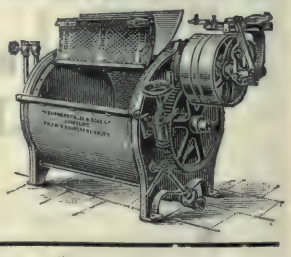
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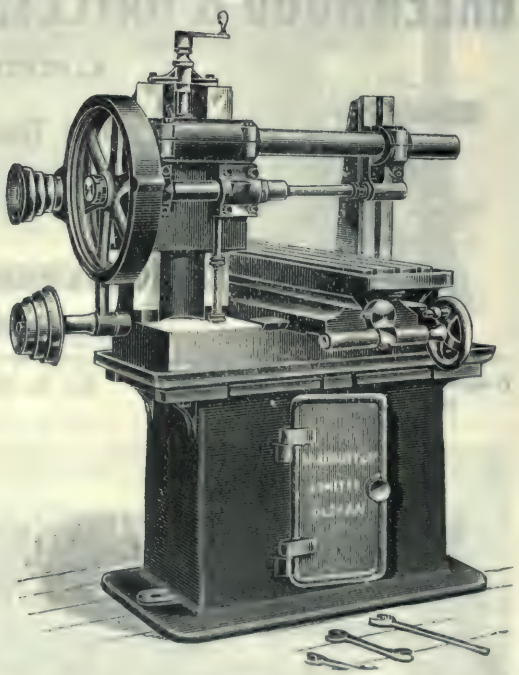
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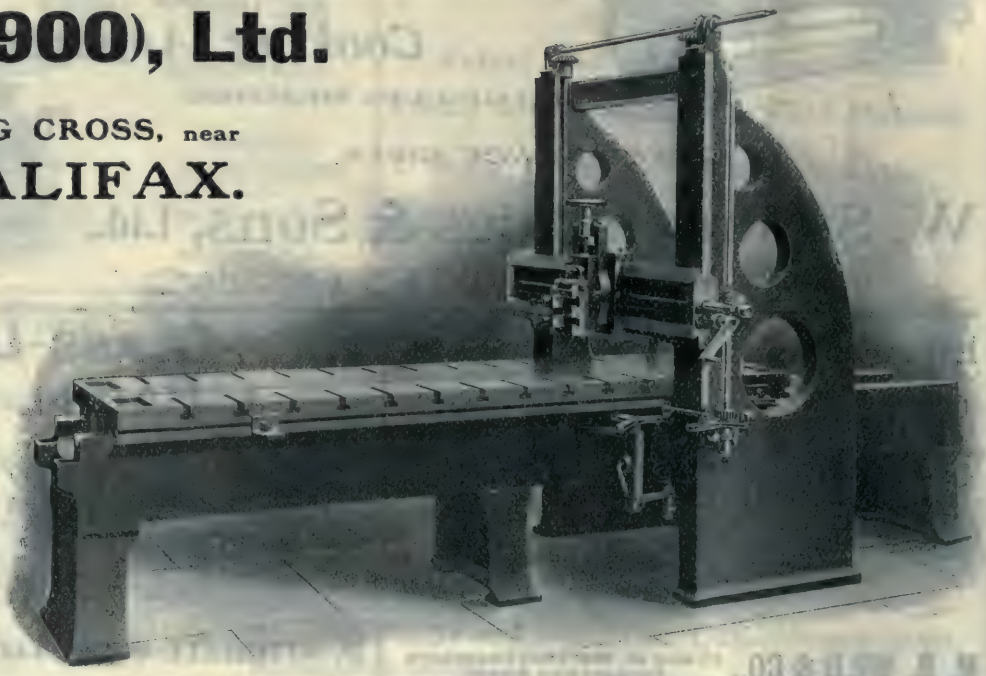
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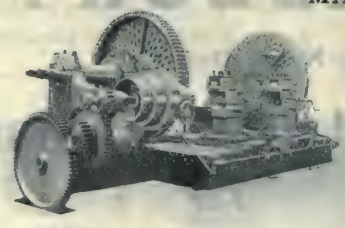
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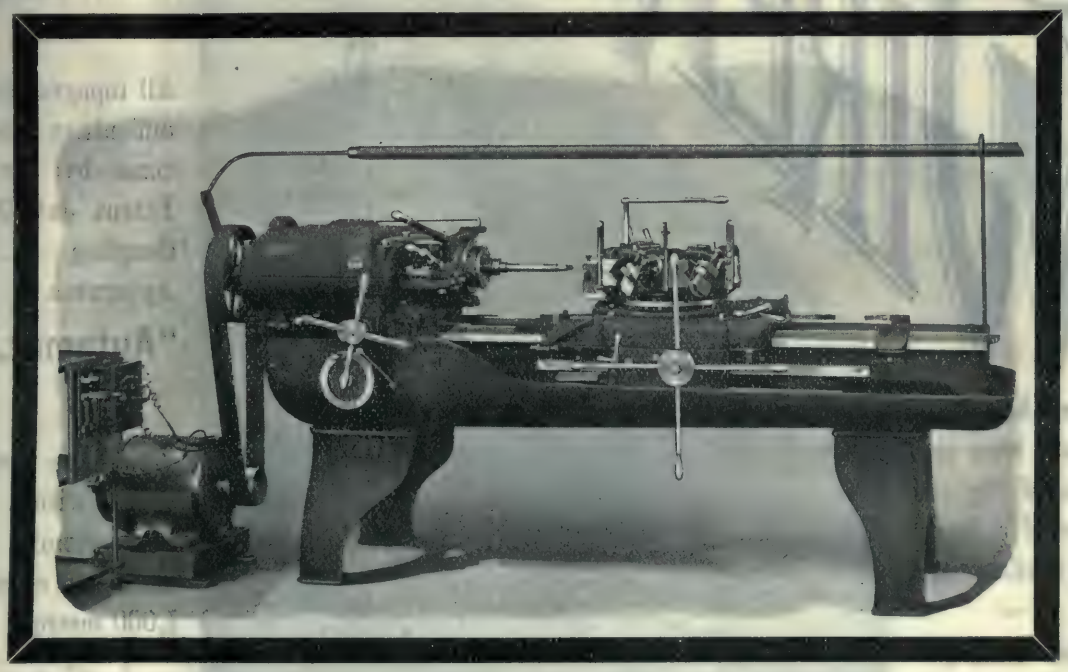
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PAGE'S WEEKLY — Machine Tools

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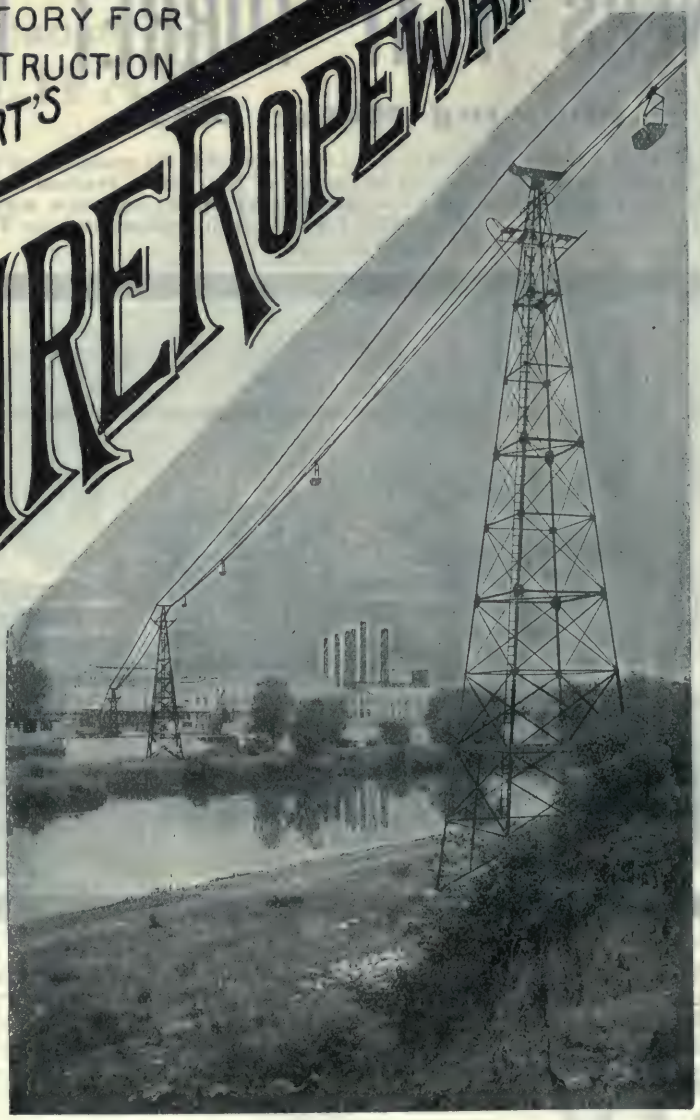
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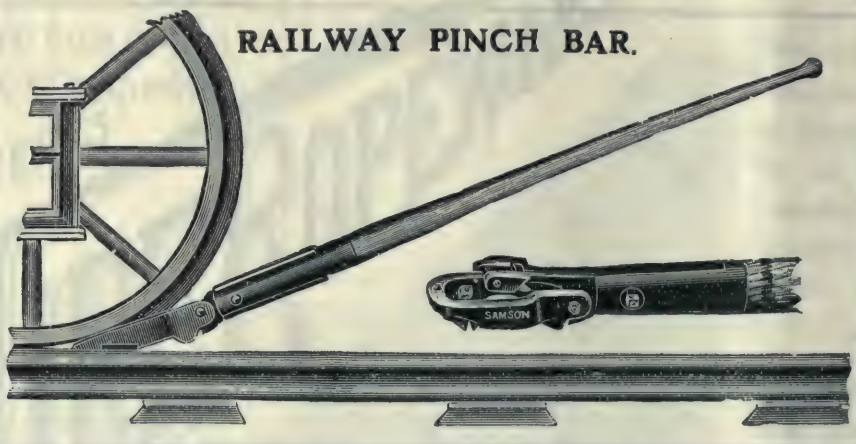
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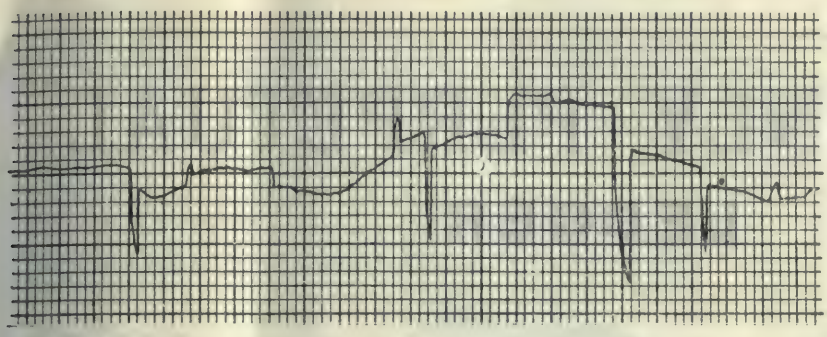
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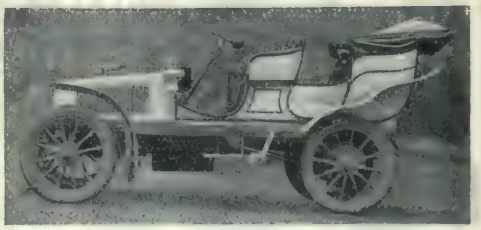
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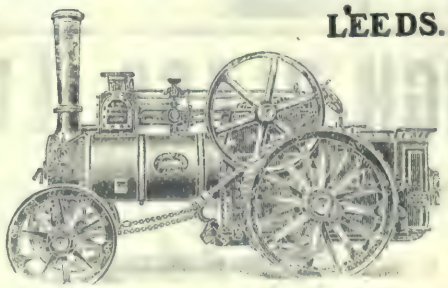
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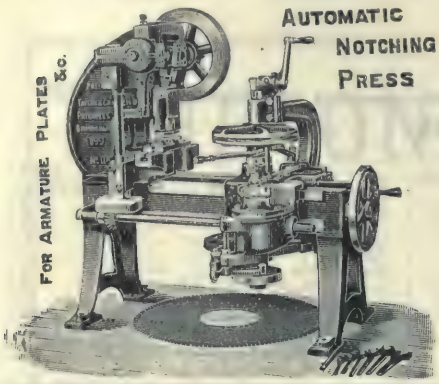


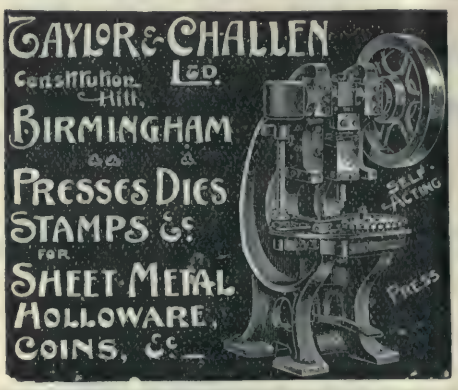
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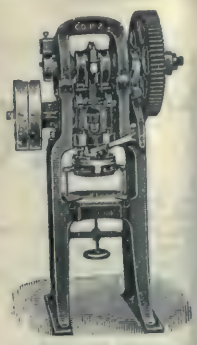
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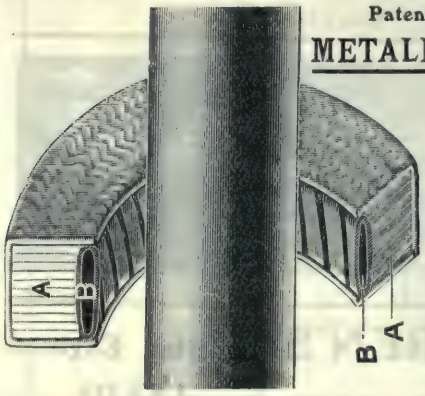
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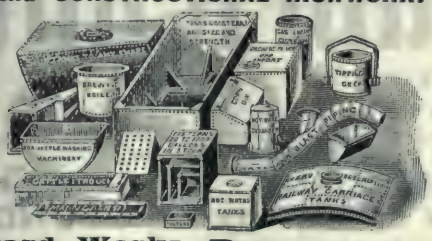


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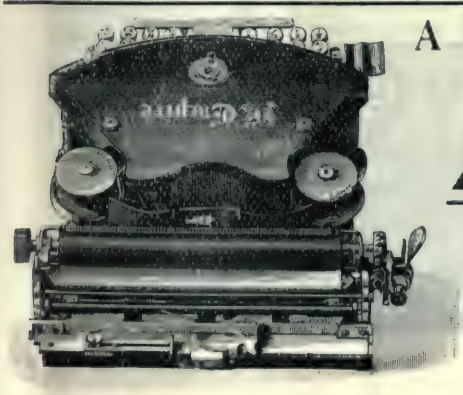
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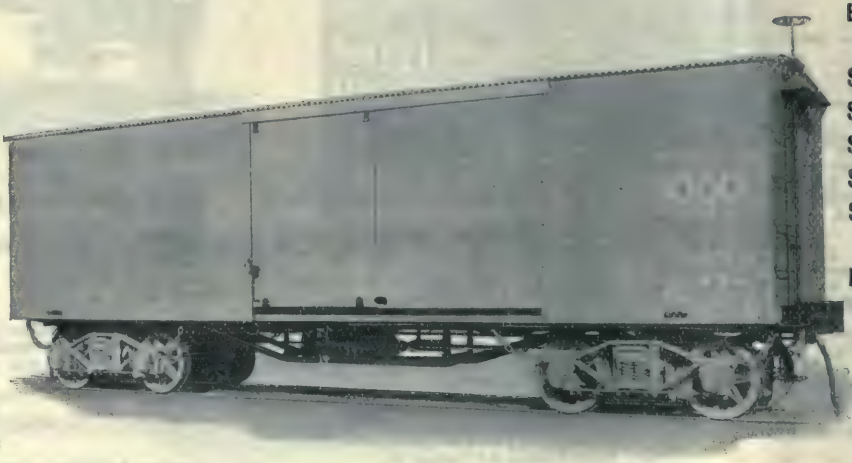
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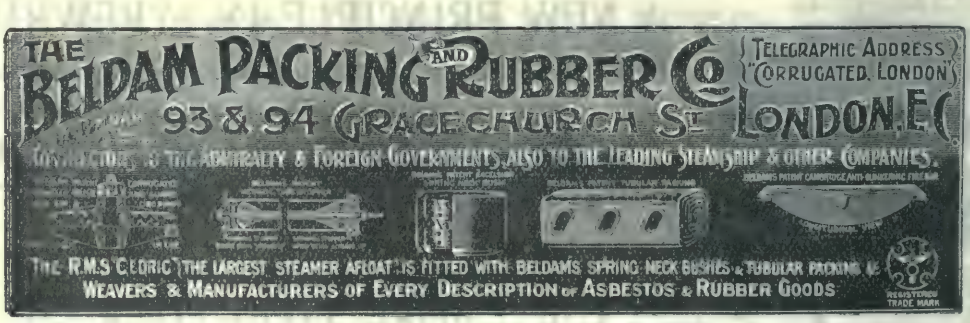
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# PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, MARCH 24, 1905. No. 28.


## The Offices of "Page's Weekly," Wednesday Evening.

THE deluge of rain which fell last Friday must have interfered considerably with the attendance of invited guests at the National Physical Laboratory, a circumstance all the more regrettable when it is remembered that an institution of this kind can only on rare occasions throw open wide its doors and welcome interruptions. The drive of Bushy House was about as soddened as it could possibly be and in the entrance hall Lord Rayleigh (President of the General Board), and Lord Kelvin received the guests in an atmosphere of mackintoshes and umbrellas. Thereafter it was a case of "go as you please." The visitors had full liberty to wander along the corridors and view the work in process in the different departments entirely at their own discretion. That veteran of science, Lord Kelvin, was encountered in several of the rooms taking the keenest interest in the work of the laboratory and showing a decided disposition to forget all about the inspection and start experimenting once more on his own account.

---

There is so much to see at Teddington and there are so many fascinating things of divergent interest, that we almost despair of being able, within the limits of our space, to afford an adequate view of the work which is in progress. Devoting ourselves to special points of interest however, it may be noted that in Room 20 (thermometry), Dr. Harker showed in operation, furnaces of a new type for the attainment, electrically, of temperatures between 800 deg. C. and 2,200 deg. C., while in room 55 was shown a new resistance box and installation for platinum thermometry, with tank for highest grade thermometer comparisons. The engineering department, under Dr. Stanton and Mr. Jakeman, is in a

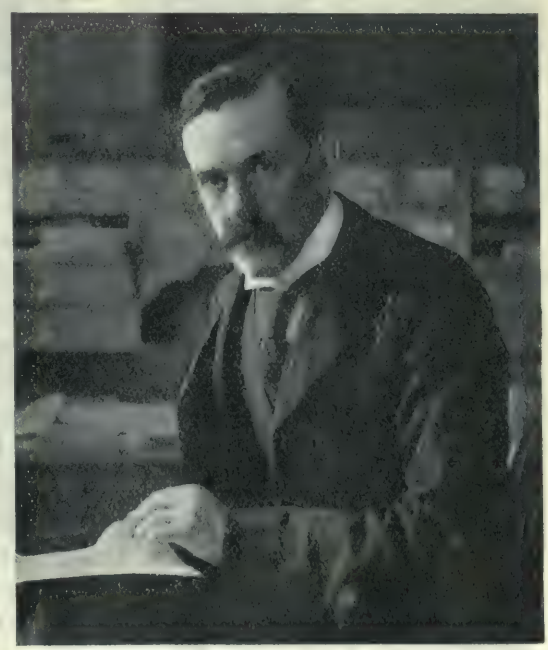


*Photo. by Elliott & Fry.*

DR. R. T. GLAZEBROOK, F.R.S.,
Director of the National Physical Laboratory.

separate building. Here we saw a quantity of apparatus which has already been freely described and also several additions, perhaps the most interesting of the latter being a 1-ton testing machine for alternate tension and compression which has just been acquired, and a photomicrographic outfit for metals.

---

A conspicuous object is the apparatus for the measurement of the pressure on surfaces in a uniform current of air, and we understand that the experiments carried on in the laboratory are now being applied to the measurements of wind pressure which are being undertaken out of doors at the tower. The Whitworth standard screw cutting lathe in another building also attracted a good deal of attention. In the Electro-technical Department, under Mr. Paterson and Mr. Rayner, the latter explained the investigations of temperature rise in transformers, by means of thermo junction wires, and excited our wonder at the extreme sensitiveness of the delicate portable voltmeter by which the temperature readings are made. In the chemical laboratory, under Dr. Caspari and Mr. Naylor, a metallurgical analysis was watched attentively, and elsewhere Mr. Campbell and Mr. Melsom (electricity), Mr. Smith (electrical standards), Mr. Paterson (photometry), Dr. Carpenter and Mr. Longmuir (metallography), Mr. Jeffcott and Mr. Attwell (metrology), Mr. Selby and Mr. Hugo (optics), Mr. Selby and Mr. Brookes (tidal prediction) ably seconded the efforts of the director, Dr. R. T. Glazebrook, F.R.S., in making the visit profitable and instructive.

---

Both as regards the work done and the state of its finances, the laboratory can look back upon a very satisfactory year. In physics department the work included, *inter alia*, a comparison of the mercury standard of resistance constructed in the previous year, the investigation of certain anomalies in standard cells, of both the Clark and cadmium patterns, the construction of the electrical portions of the ampere balance for the British Association, and numerous tests of the dielectric resistance of different varieties of gutta-percha. Progress was made in equipping an electro-technical department to undertake the testing of electrical apparatus on a commercial scale, and electrical research work was carried out on behalf of the Engineering Standards Committee to determine the maximum temperatures permissible in electrical machinery. (See PAGE'S WEEKLY, page 571.)

---

In the thermometric department a considerable amount of new apparatus was installed, and the work included the final stages of a research on the specific heat of iron at high temperatures and the beginning of a study of the resistance and thermo-electric properties of solid electrolytic conductors such as are used in Nernst lamps, with the view of designing a system of electrical high-temperature measurements based on some of the properties of zirconia, yttria, etc. In the metallurgical department extensive tests were carried out on a series of nickel, carbon, and manganese iron alloys, prepared by Mr. Hadfield at the Hecla Works, Sheffield, and also an inquiry into the critical ranges on heating and cooling of modern high-speed tools.

---

In the photometrical department intercomparisons were made by means of glow lamps with the National Standards Bureau, Washington, and the Electrical Testing Laboratories, New York, as well as with the Berlin Reichsanstalt, and further investigations are now being undertaken to determine the ratios between the standards of candle-power accepted in America, Germany, France, and Great Britain. In the engineering department the standard leading screw lathe referred to above was fitted with a compensation bar to correct its errors and is now true to within 0·0001 in. over the length of 36 in.; it has been used to cut



INTERIOR VIEWS AT THE NATIONAL PHYSICAL LABORATORY.

These views, reproduced by courtesy of The World's Work and Play, show (1) The Engineering Laboratory, (2) The Metallurgical Laboratory. In the upper picture the wind apparatus is seen on the left.



THE APPLICATION OF REINFORCED CONCRETE IN DRY DOCK CONSTRUCTION AT HUNTER'S POINT, CAL. (*See page 626.*)

a screw for Armstrong, Whitworth and Co., the errors in pitch of which, measured from one end, lie between 0·0003 and 0·0002 in. in a length of 36 in. The effects of wind pressures on structures and the resistance of materials under alternating stresses have also been under investigation. Much of this work is being continued during the present year, and among new researches proposed may be mentioned the influence of impurities on copper, the relation of carbon to iron in cast iron, and the so-called constituents of quenched steels. In addition to these and other researches which have been successfully carried through, a number of inquiries have been declined for want of sufficient equipment. The Committee hope that this may, however, be shortly remedied. During the year some 28,000 instruments of various kinds were tested. Of these, more than half were clinical thermometers.

---

At the beginning of the year the financial position was a source of anxiety, but large additions to the donation fund and increase of work in the latter part of the year turned the loss that was feared into a credit balance, the expenditure being £12,257 3s. 7d. and the receipts £12,753 3s. 9d. But this result, satisfactory though it is, was due in great measure to efforts made to increase the donation list, and the committee recognise that such a source of income is necessarily precarious. The Treasury has agreed to increase the annual grant for 1905–1906 from £4,000 to £5,500, and will in addition be willing to consider the increase of this sum in 1906–1907 to £6,000. In regard to the memorandum of the committee pointing out the need for capital expenditure on new buildings and equipment to an amount approaching £30,000, the Treasury replied that with every desire in the public interest to develop the resources of the laboratory, it felt that in view of the financial exigencies of the time and the numerous demands on the exchequer, this somewhat extensive programme could only be carried out by being spread over a number of years; but it was prepared to ask Parliament for an additional grant of £5,000 for 1905–1906, and hoped that for four or five years to come it might be possible to provide an equal sum.

---

As to the gradual improvement in the management of the Transvaal mines, Mr. H. Ross Skinner, whom we quoted last week, is of opinion that this should further increase as years go on owing to the larger number of young men who will be available, and who have made mining their profession and practically their life's study. He advises them to always remember that book knowledge alone will not make a manager, but has to be combined with the great gift of common-sense, and the ability to handle men. The Government examination will also gradually tend towards raising the standard, but the giving of a Government certificate should be counted as the foot and not the top of the ladder. It is only by reading, observing, and thinking that a manager can keep pace with the times and be able to cope with the problems incidental to the running of a mine.

---

In the abstract of Lord Brassey's paper on "Shipbuilding for the Navy," issued by the Institution of Civil Engineers, we note :—

"The author concluded by urging the desirability of discussion on such questions, which were of exceeding complexity and momentous import to the nation. It had been decided that the proceedings of the Admiralty Advisory Committee on Shipbuilding should not be made public. Such discussions as those which might from time to time be held under the auspices of the Institution of Civil Engineers were the more valuable for the guidance of public opinion."

It is difficult to see how public opinion is to be guided by discussions from which pressmen are rigorously excluded.

# PAGE'S WEEKLY

**An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.**

**DAVIDGE PAGE, Editor.**

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.


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# NEWS ITEMS.

The *Victorian*, the newly-built Allan Line steamer, is the first turbine engined boat to cross the Atlantic.

A new Japanese battleship, the largest warship yet built on the Tyne, was launched at Elswick on Wednesday.

The persistent rumour of a projected amalgamation between the British Westinghouse Company and Armstrong, Whitworth and Co., Ltd., is officially denied.

The Permanent Committee of the International Congress of Technical Education have accepted an invitation for the holding of the next meeting at Milan in 1906.

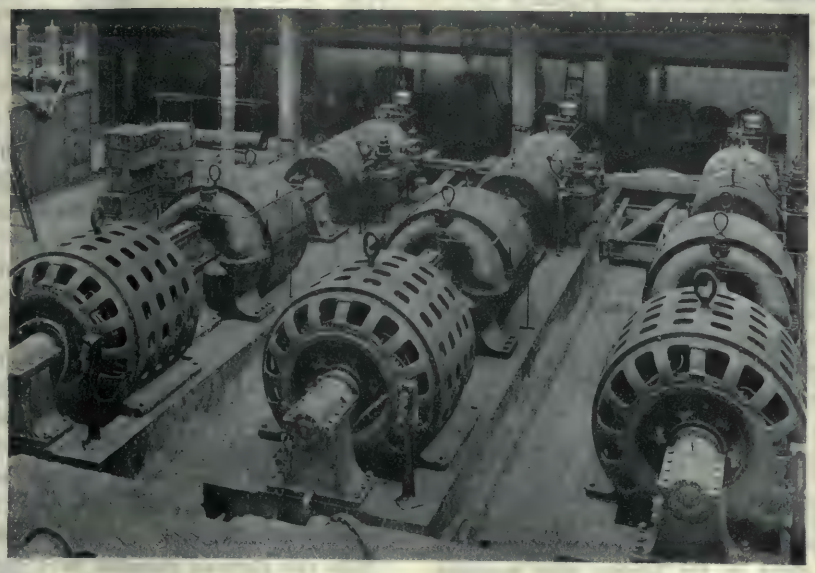
At the annual meeting of Messrs. William Beardmore and Co., last week, Mr. Albert Vickers said he was happy to report that the new shipyard at Dalmuir was now practically completed.

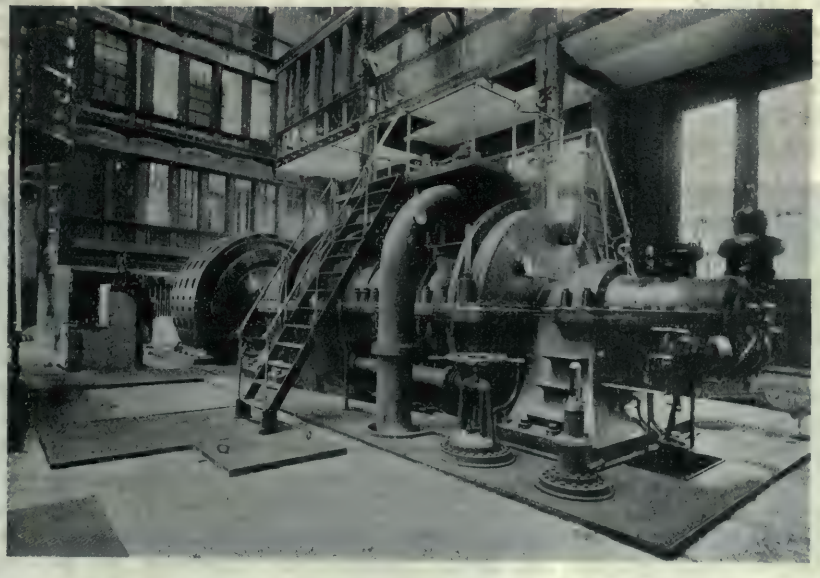
Early on Tuesday morning a successful trial trip was run with an electrical train over the portion of the Metropolitan Railway on the Inner Circle from Baker Street to South Kensington and back, and from Baker Street to Aldgate and back.

We are pleased to receive confirmation of the following paragraph, which recently appeared in the daily Press: On Saturday, February 25th, the Manchester engineering firm of Messrs. Isaac Storey and Co. received an order by wire for an auxiliary condenser of 900 square feet required by a large shipbuilding company. The condition was attached that delivery must be made by Monday, March 13th. The firm had no finished parts of any description in stock for this work, and had to make the whole condenser from raw material, but they managed to deliver the condenser on Friday, March 10th, two days earlier than required.

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RECENT TURBINE INSTALLATIONS—VI.

(1) Three 1,250 k.w. Westinghouse-Parsons steam turbine generating units in 59th Street Power House of Interborough Rapid Transit Company, New York. (2) 7,500 h.p. Westinghouse-Parsons steam turbine generating units in 74th Street Power House of the Company.

## Prizes Offered for Machinery.

We have just received the following details of prizes which are to be awarded by the Association of Italian Manufacturers for the prevention of accidents in factories, in connection with an international competition to be held during the Milan Exhibition next year :—

A gold medal and 8,000 lire for a new appliance for preventing accidents arising from contacts between primary and secondary windings in alternate current transformers. The appliance must fulfil the condition that no disturbance in the action of the transformer must arise in case of atmospheric discharges or abnormal increase of potential.

Gold medal and 1,000 lire for a novel system of hand crane or winch fitted with a simple and practical contrivance to prevent the possibility of the handles revolving during the descent of the load.

Gold medal and 500 lire for a safety appliance, to be simple, strong and reliable, to stop trucks automatically on an inclined plane on the hauling rope snapping. The appliance must be adaptable to existing plant.

Gold medal for a sytsem of absorbtion and collection of the dust produced in sorting and cutting rags by hand without giving rise to draughts detrimental to the health of the workpeople.

Gold medal for a system to carry off by suction the dust generated by carding flax, hemp, and jute, without detriment to the neighbourhood.

Gold medal for a system to prevent the diffusion of dust in lime and cement works.

## Overhead Mains.

Reference was made during the recent discussion on "Overhead Mains," at the Institution of Electrical Engineers to the troubles likely to arise in connection with overhead wires which are carried along main roads. An interesting point in this connection arose at the conference of municipal tramway authorities which has just been held in London. It was in relation to the protection of overhead trolley wires At the present time when the Postmaster-General or the National Telephone Company desires to place an electric wire over those of a tramway, it becomes the duty of the tramway authority whether a company or a municipality, to protect the live wire so that the telegraphs or telephone wire may not come in contact with it. This is throwing an unfair burden on the electric tramway interests, more particularly if the overhead equipment of the tramway should have been in position first. In such a case it might be fairly argued that the Post Office or the National Telephone Company should be charged with the duty of affording the necessary protection, and it was decided to ask the Board of Trade to receive a deputation on this matter and on the question of the construction of cars and other matters in connection with the working and equipment of tramways.

## Metallic Calcium.

Electrometallurgy has at last succeeded in producing metallic calcium in commercial quantities, and at what must be considered a relatively low price. Until within a few weeks ago this metal had only been available in very small amounts, and remained a rare laboratory specimen; it is now obtainable at a price per kilogramme less than that charged by most chemical dealers for a small one gramme sample. Humphry Davy first formed the amalgam by electrolysing lime, mixed with mercuric oxide and slightly moistened, with a mercury kathode; he isolated the metal in small quantities by distilling off the mercury. Since then many chemists have tried in vain to find a method suitable for its preparation on a larger scale.

Now two German chemists have brought about an extraordinary slump in the market by a new patented process. The metal is being placed on the English market by Messrs. Armbrecht Nelson and Co., of 71 and 73, Duke Street, Grosvenor Square. Its price according to chemists lists, has changed as follows :—

| | |
|---|---|
| 1903 .. .. .. | £56 5s. 0d. per oz. |
| 1904 .. .. .. | 25 0s. 0d. per oz. |
| 1905 (Jan.) .. .. | 9 0s. 0d. per oz. |
| 1905 (March) .. .. | 0 1s. 6d. per oz. |

From being a mere laboratory curiosity it has become cheap enough to experiment with extensively in connection with the manufacture of armourplate.

## The Egyptian State Railways.

Lord Farrer's Commission on the Egyptian State railways recommend the construction of new lines entailing a total expenditure of £700,000. The gap between Assouan and Wady Halfa, 200 miles, it is considered, must sooner or later be bridged, and the Commission think it would pay better to link up the systems by spending £1,000,000 (E) than by spending £600,000 on widening the existing Luxor-Assouan line, and the project of uniting the two systems—the Egyptian of 1,667 miles and the Sudanese of 700 miles—is most worthy of immediate attention, as being quite likely to give a return on capital in a comparatively short time. The Commission find that the administration of the port of Alexandria should be separated from that of the railways. The capital expenditure necessary to improve the existing system and provide the necessary rolling stock is altogether £2,923,750 (E).

# MOTOR NOTES.

## John I. Thornycroft and Co.

A new Thornycroft vehicle is shown in fig. 1, a special 20-h.p chassis having been fitted with British Vacuum Cleaner Company's plant. The great advantage of the vehicle is that it is self-contained, and the petrol engine can be used to drive the cleaning part alternately with driving the car. There are undoubtedly great possibilities in a combination of this description.

The vehicle is to carry five persons and the cleaner plant up a gradient of 1 in 10. The average working speed on the level is fifteen miles per hour. The engine is of the four-cylinder "Otto" cycle type, with cylinders 4 in. diameter and 4⅜ in. stroke. The cylinders are cooled by water circulation, operated by a pump of the rotary gear type. The ignition fitted is high tension electric accumulator or dry cell. The steering is easily effected from the foot-plate by a diagonal shaft and hand-wheel, operating a worm and worm wheel, and is powerful and irreversible.

The wheels are of the artillery pattern, 34 in. diameter with metal naves, oak spokes, and ash felloes. A pedal on foot-plate operates a brake upon the counter-shaft, close to the gear box equally effective in either direction, and sufficiently strong to hold the vehicle on the steepest hills. The frame is of strong channel steel, with suitable stiffeners and gussets.

## Napier Marine Engine.

The recent sensational trials of *Napier II*, when with a hull specially constructed by Messrs. Yarrow and Co. a speed of thirty miles per hour was obtained with a boat 40 ft. long, has naturally directed attention to the Napier marine engine, and the attempt which is being made to apply the internal combustion engine to marine work is being closely watched by engineers. The opinion has been expressed that to enable such an engine to be built in the large sizes necessary for marine work will mean the development of some form of producer gas engine, but, be that as it may, and while giving every credit to the ingenious design of the hull of the Napier-Yarrow boat, to which the high speed attained is in no small measure due, full recognition must be accorded to the part played by the Napier engine.

The engine is constructed of cast-iron, the engine body being in two halves joined along the centre of the shaft and the cylinders themselves consist of liners forced into the body, which is bored to receive them, by haudralic means. The cylinder heads are one casting, a pair of cylinders for each head, and are bolted through on to the engine body. The crank-shaft is of forged steel, and the bearings are bronze, and very great care is taken in letting together the main bearings and the big ends. The cam-shaft is cut from a solid




FIG. 1. 20-H.P. THORNYCROFT CHASSIS, WITH VACUUM CLEANER PLANT.

bar, and is case-hardened and ground to its final dimensions. This system of grinding is the most suitable method for this class of work, as not only can hardened steel parts be used, but the very finest degree of accuracy may be obtained. A great feature of this engine is its flexibility. It is capable of being throttled down to 150 or 200 revolutions, and then accelerated to 1,200, and in all speeds the engine is said to run silently and with practically no vibration.

### Special System of Ignition.

The carburetter has been designed to work properly under the usual conditions met with at sea, and it works perfectly in an open boat, no matter the condition of the weather. The throttle is designed so that it automatically keeps the value of the mixture constant, and does not slow the engine down by simply destroying the value of the mixture. The whole system of ignition has been devised to work satisfactorily in damp and wet, and to withstand the corrosive action of sea water.

The system of lubrication is the same as that in use in high-speed electric lighting engines—direct forced lubrication, which is automatic. The Napier reverse gear is noticeable by its great contrast to any other attempt that has been made by engineers to obtain a reversal motion of propeller shaft, driven by an internal combustion engine. In many cases we see a large cumbersome device, in which gears and mechanism usually become corroded and fixed unless the gear receives a considerable amount of attention. In the case of the Napier gear, everything is covered and free from the effects of salt water, all the gear and mechanism being enclosed in an oil-tight box, and running submerged in oil.

In this gear there are three positions—ahead, intermediate, and astern. When the lever is placed in the ahead position the gear is firmly and absolutely locked for the ahead movement, and is practically nothing more than a rigid shaft carried in two roller bearings, and provided with a ball-thrust bearing. There is no other gear or mechanism moving, and as this spindle is working submerged in oil no attention is required to thrust or steady bearings. If the lever is placed in the intermediate position, this shaft is broken or disconnected, end from end, but still runs on a very long, substantial spigot bearing, so that the engine shaft can rotate, and the propeller shaft remain free with a minimum of friction and no chance of wear. In the astern position the shaft still remains broken but there is interposed a countershaft, with an interposed gear wheel, which gives an astern or opposite motion to the propeller shaft, and reduces the speed of same.

These three positions are positive, and in connection with this reverse gear is a metal to metal clutch, also running in oil, which, in the Napier practice, forms part and parcel of the flywheel.

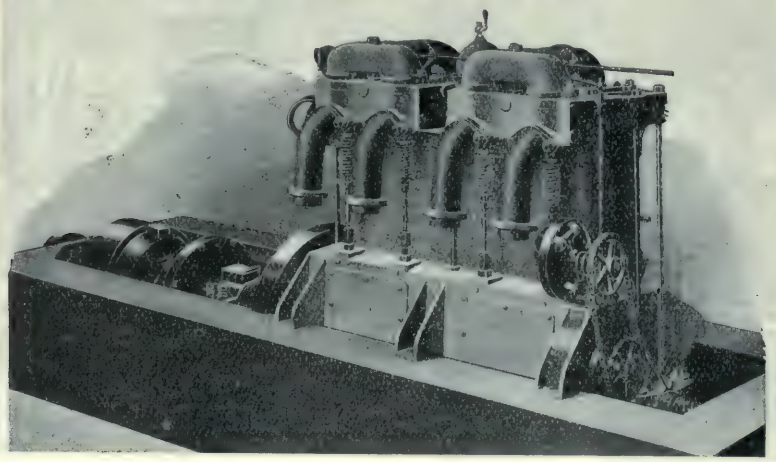


FIG. 2. THE NAPIER 66-M.P. MARINE ENGINE.

### The Lanchester Engine.

The Lanchester cars have deservedly won a high reputation for good design and workmanship, and in the new model are one or two new features which are worthy of notice. The most notable departure from their former practice is in the engine. This is of the generally accepted multi-cylindered vertical type. It is placed in the front of the car dividing the foot-board, this position being a distinct advance in accessibility, as, when the bonnet is removed, the engine presents a clean "broad side," whereas if placed in the position usually adopted, access to the engine is obstructed by the wheels and mudguards. The crank-chamber forms an oil well from which the whole of the engine is lubricated automatically under high pressure by means of a pump.

Either magneto or high-tension, with accumulators and trembler coils can be fitted. The water circulation is automatic or thermosyphonic.

The special radiator is constructed from a number of flat cellular plates in which the cells run vertically ; it is exceedingly efficient and is simpler and neater in appearance than any radiator previously designed. It is also very easy to clean, having no small cells or crevices such as honeycomb and tubular radiators

with gills have, in which mud will collect, and is sometimes very difficult to dislodge. The clutch is a multi-disc metal to metal one, of the most up-to-date type, and enables the driver to start the car smoothly and silently on the top gear without the slightest shock to the passengers.

The change-speed gears are similar in principle to those previously fitted to Lanchester cars; the gears and the clutch and the main brake being enclosed in an oil-tight gear box, are immersed in oil.

The arrangement for connecting the car frame to the under frames is of somewhat novel construction, The ordinary type of carriage spring is departed from, and, instead of this a single spring is used at each of the four suspension points, acting on the cantilever principle.

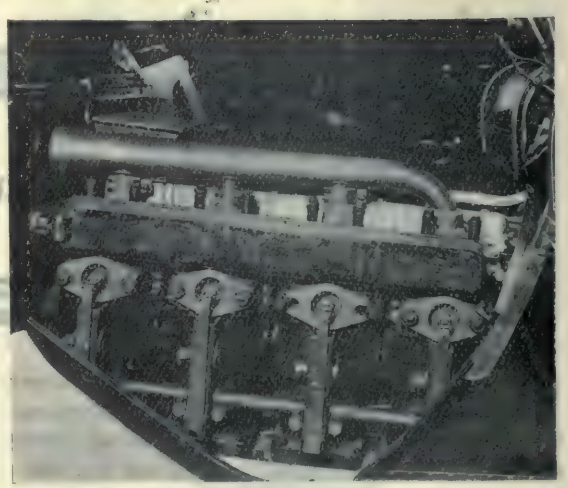


FIG. 3. LANCHESTER MOTOR. SHOWING SIDE ELEVATION.

## Garrett 4-5-Ton Motor Lorry.

The exhibit of Messrs. Richard Garrett and Sons has attracted a good deal of attention at the Agricultural Hall, and fig. 4 shows the features of one of their compound steam motor lorries.

The main frame consists of two steel channels of heavy section running the whole length of lorry; they are stayed by cross steel channels of heavy section, bolted on top, and at the back end by two diagonal steel plate stays riveted one on the top, and one on the bottom of steel channels, with proper provision for the trailing pin; at the front end the channels are stayed by a single cross plate bolted to the top. To the two longitudinal steel channels are bolted the pressed steel housings for the springs.

The engine gear box is suspended at three points from the main frame, viz., at the back end by two cast-steel brackets bolted to the two longitudinal steel channels, one on each side, and at the cylinder end by one suspension bolt in the centre, attached at the top to the two cross channels, and at the bottom to the engine gear box by nuts and indiarubber washers, to permit freedom of action and nullify vibration.

The cylinders are compound high and low pressure, mounted horizontally, side by side, and constructed with outside valve chests, rendering the slides easily accessible. The high-pressure cylinder is fitted with piston valve. the low-pressure cylinder with slide valve. The cylinders are lagged with special non-conducting material and sheet steel and provided with drain cocks, double sight-feed lubricator for high and low-pressure cylinders. The engine is noteworthy for its simplicity as a compound engine for this purpose, numerous usual moving parts and joints being dispensed with.

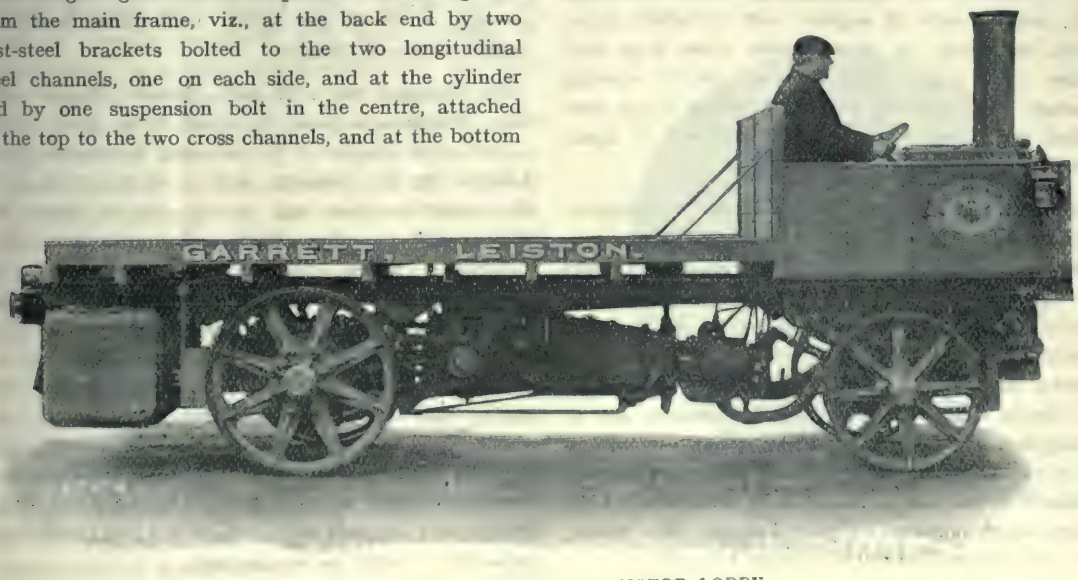



FIG. 4. GARRETT 4-5-TON STEAM MOTOR LORRY.



# SHIPBUILDING NOTES.

ON Tuesday afternoon the s.s. *Othello* was launched from the yard of the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, the vessel being to the order of Messrs. C. T. Bowring and Co., Ltd., Liverpool. She is 353 ft. long and 47 ft. 3 in. beam by 28 ft. 3¾ in. deep, and has been built under special survey to the highest class at Lloyd's. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes is being arranged for, consisting of seven steam winches by Messrs. Clarke, Chapman and Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam steering gear by Messrs. The Harrison Engine Company, Manchester, and steam windlass by Messrs. Emerson, Walker, and Thompson Bros. The boat is fitted with the usual water-ballast arrangement for light passages. The bunkers and tank in engine and boiler space are coated with Messrs. Wailes, Dove and Co.'s patent bitumastic enamel. The machinery will be supplied by Messrs. The Wallsend Slipway and Engineering Company, Ltd., and consists of engines with cylinders 24 in., 40 in., and 66 in. by 48 in. stroke, three large steel boilers 13 ft. 9 in. by 10 ft. 6 in., 180 lb. working pressure. The steamer will carry about 6,150 tons loaded and is expected to steam at about 10 knots speed.

Messrs. R. Williamson and Son, of Workington, recently launched the steel-screw steamer *Queenie*, which has been built to the highest class at Lloyd's for Messrs. Alf. H. Keep, Ltd., London. The principal dimensions are: Length, b.p. 134 ft. 9 in.; breadth, 23 ft. 10 in.; depth, m.l.d. 10 ft. 9 in. The vessel is designed to carry about 400 tons deadweight on Lloyd's summer freeboard. The engines are to be supplied by Messrs. Ross and Duncan, Govan, and are of the compound surface condensing type, having cylinders 18 in. and 36 in. with a stroke of 24 in., steam being supplied by a cylindrical steel boiler, 12 ft. by 10 ft. working at a pressure of 125 lb.

The steel screw steamer *Anselm*, the latest addition to the well-known Booth Line of Liverpool, left the shipbuilding and engineering works of Messrs. Workman, Clark, and Co., Ltd., Belfast, on Monday morning for her speed trials and adjustments of compasses in Belfast Lough, and after a satisfactory cruise, proceeded to Liverpool to receive cargo and passengers for her initial voyage. The vessel is 415 ft. long, and her gross tonnage is 5,450; she has been built under Lloyd's special survey for their highest class. The most prominent feature of the *Anselm* is her accommodation for passengers, there being about sixty handsomely appointed staterooms on the upper and bridge decks, variously arranged in size and furnishing to accommodate one, two or three passengers. The machinery and boilers have been constructed by Messrs. Workman, Clark and Co., at their Queen's Road works and consist of a set of triple expansion engines with all the latest improvements to develop upwards of 4,500 h.p., steam being supplied by four steel multitubular boilers working at a pressure of 180 lb. per square inch under Howden's system of forced draught.

On Tuesday the 21st inst., Messrs. Ropner and Son, Stockton-on-Tees, launched from their yard, a steel-screw steamer of the following dimensions, viz.: Length, 337 ft.; breadth, 48 ft.; depth, 28 ft. 5 in. The vessel has been built to the order of Messrs. R. Ropner and Co., West Hartlepool, and is fitted with the builder's patent improved trunk deck, having a tier of hold beams in addition to the complete trunk deck, and is fitted with T. G. forecastle on trunk deck. A double bottom is provided for water ballast on the cellular principle, also in the fore and after peak tanks. The deadweight carrying capacity will be about 6,000 tons on Lloyd's summer freeboard. The engines will be of the triple expansion type supplied by Messrs. Blair and Co., Ltd., of about 1,400 i.h.p., steam being supplied by two main boilers at a working pressure of 180 lb. per square inch.

# Recent Advances in Metallography.

MR. J. E. Stead, F.R.S., lectured on "Metallography" to the Royal Microscopical Society last week, dealing with the work achieved by modern investigators in this field. Of these Mr. Stead is himself one of the foremost. The lecture to the Microscopical Society was a brief history of researches, which have had an important bearing upon one of our great industries.

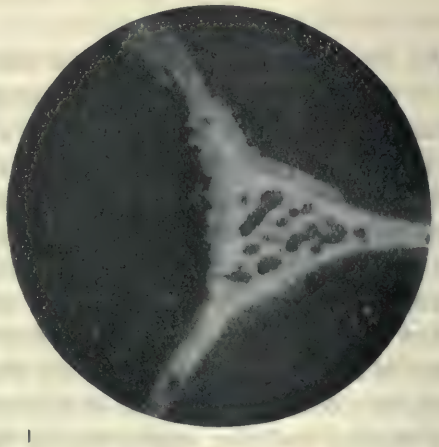
The most important part of the lecture was, perhaps, that relating to the detection of phosphorus in steel under the microscope. Mr. Stead described various methods of detecting phosphorus, and pointed out the importance of increasing the knowledge as to the incidence of impurities in steel.

Mr. Edward L. Buttenshaw read a paper before the Manchester Students' Section of the Institution of Electrical Engineers on the same subject, and the illustrations shown, reproductions of photographs shown at Manchester, are the work of Mr. Stead. The author states that one of the most important elements in steel is phosphorus. This occurs in steel up to '07 per cent., this amount in castings is not particularly harmful if not required to stand strain; but for forging purposes and material that has to withstand strain or shock, it should not exceed '03 per cent.

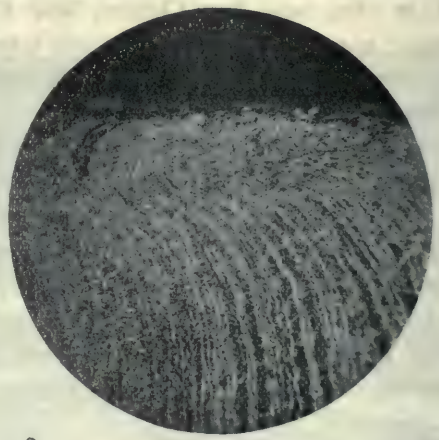
Like sulphur, phosphide of iron aggregates to the edges of the grains. The serious nature of this weakness can be understood when considering the alternating strains imposed on a forged axle. The hardness of iron is steadily increased with each addition of phosphorus. As a rule, etching with nitric acid acts more severely on the junctions of the grains than on their mass when phosphides are present, but this is not invariably the case.

Examined under a high magnification, after etching with dilute warm sulphuric acid the phosphide can be easily detected. The more usual form of phosphide, as seen in pig-iron, has a curious speckled appearance, but is in small patches only. The author showed a specimen containing 10·2 per cent. of phosphorus and compared it with a similar specimen containing 11·07 per cent. or only ·87 per cent. more phosphorus. The crystals seen on the latter were the pure alloy of iron and phosphorus chemically known as $Fe_3P$.

An instance of the flow of metal under pressure is well seen in fig. 2, which represents a chisel-head that has been well used. The crushing of the grain from its original position is well seen.



1



2



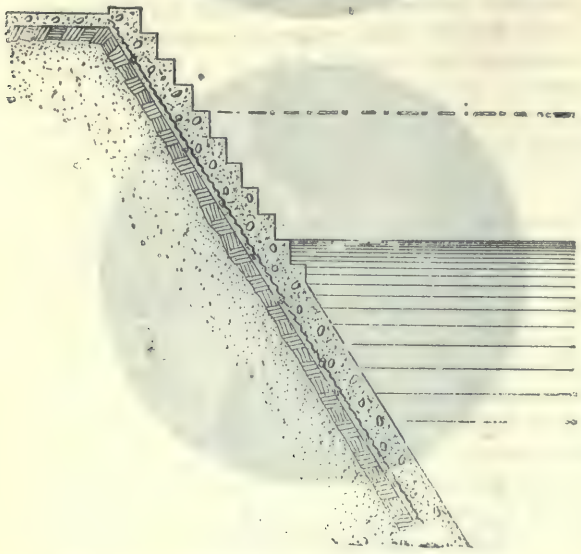
3

Fig. 1. Phosphide eutectic.
Fig. 2. Chisel-head after use.
Fig. 3. Copper containing bismuth.

# Armoured Concrete and its Application.

WE reproduce in this issue several illustrations of the use of expanded steel in armoured concrete. In a comprehensive review of this system the New Expanded Metal Company remind us that Jean Monier, a gardener living in the neighbourhood of Paris, is generally given credit for the invention, in 1876, of the system of construction which, for five-and-twenty years, has been called by his name, although Francois Coignet, of Paris, had taken out Letters Patent in 1869, on a combination of iron and concrete, and a building had been constructed by W. E Ward, in 1875, near Port Chester, New York, in which " not only all the external and internal walls, cornices, and towers were constructed of beton (concrete), but all of the beams and roofs were exclusively made of beton, reinforced with light iron beams and rods."

In 1876 Monier needed some large pots in which to plant orange trees, and he conceived the idea of using concrete with wire netting embedded in it to give strength. He received a diploma at the Paris Exposition of 1878, and, finding that his invention covered a much larger field than he had supposed, brought the matter to the attention of engineers and capitalists, with the result that, in a comparatively short time, many tanks, bridges, sewers, and the like were built on his system in France, Germany, and Austria. It was only a step from this to the construction of fireproof doors, large numbers of which have since been built in Europe.



SECTION OF DOCK AT HUNTER'S POINT, CAL.

It is claimed that by this combination an ideal construction is produced which is capable of wide application. The use of expanded metal ensures that the steel is well deployed in the slab, for notwithstanding its mesh form it is still remains a solid sheet.

The usual type of expanded steel for armoured concrete construction is that known as 3-in. mesh. This mesh measures 3 in. by 8 in. from centre to centre of intersections, and, obviously, each intersection is twice the sectional area of its strand. As the metal is stronger when the sheets are laid with the long way of the meshes from support to support, it is generally used in that manner.

In practical working of this form of construction, after the temporary centring has been erected, the expanded steel is laid immediately upon it, with not less than one mesh lap in each direction where the sheets join. The concrete is then placed upon the steel and is thoroughly well scraped, spaded and tamped down into the meshes to ensure the metal being completely embedded, and the meshes entirely filled. This action lifts the expanded steel into its ideal position, viz., about $\frac{1}{2}$ in. from the face of the concrete.

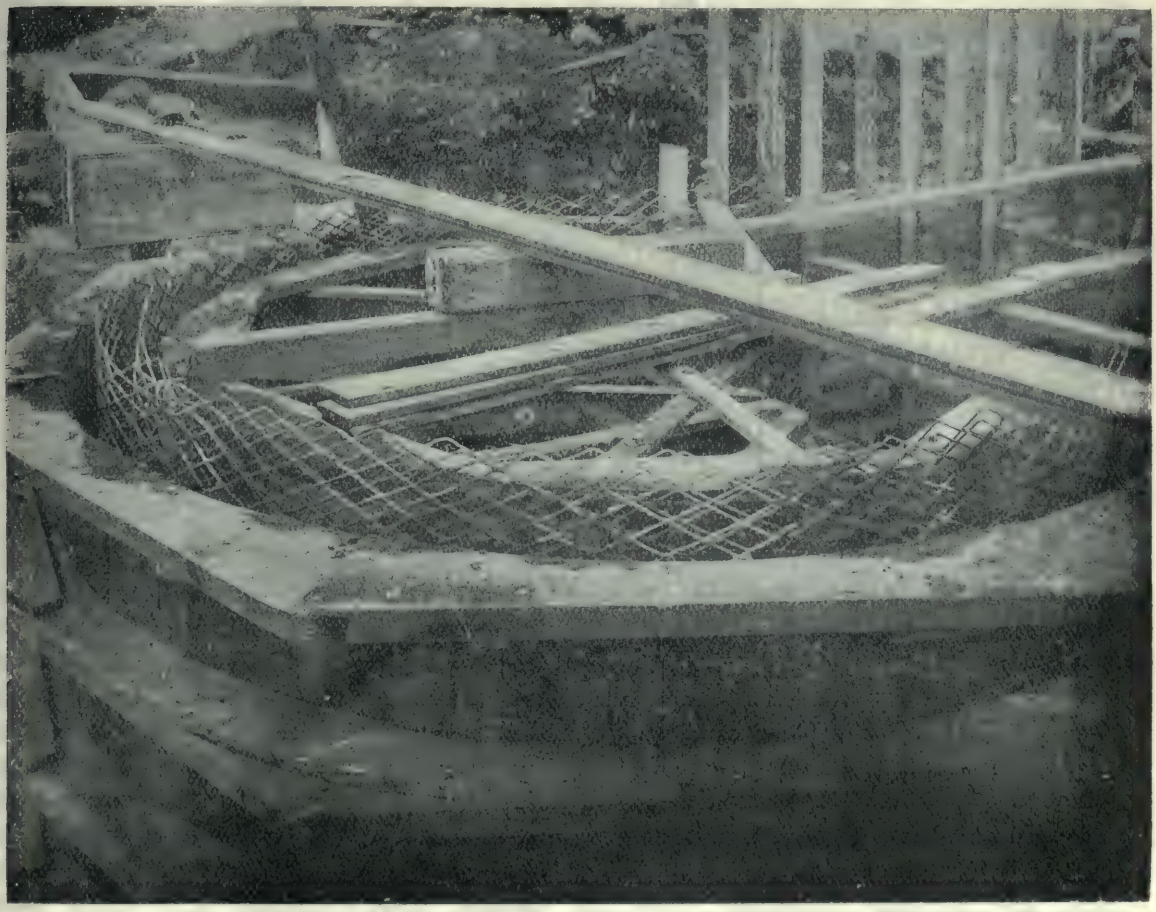
If the concrete is to be faced, with sand and cement, or granolithic finish, the facing is applied while the concrete is green, but if this cannot be done, and the facing has to be applied after the concrete has gone off, the latter is

well swept and freed from dust, wetted with clean water, and, if necessary, sprinkled with dry cement to ensure the facing taking properly to the concrete.

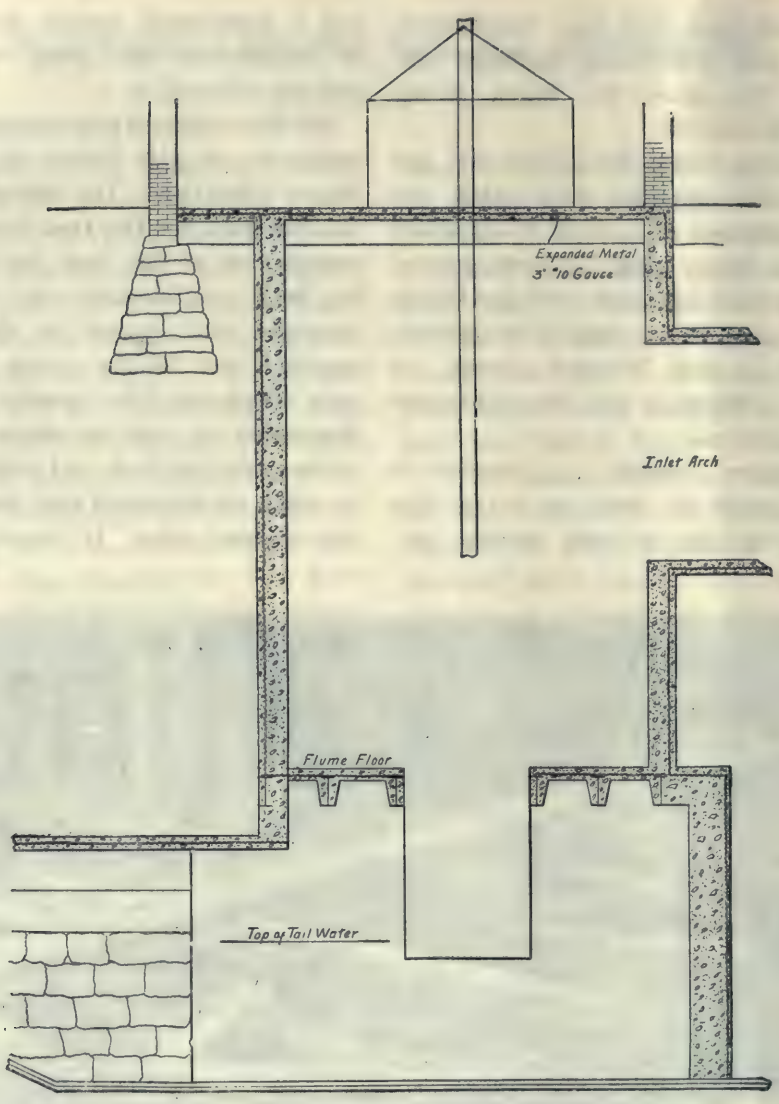
The concrete is turned three times dry, and three times after water has been added, and should be composed of 4 parts of approved aggregate, say clinker, brick, slag, stone, granite, etc., broken to pass a ¾-in. mesh sieve, and having about 30 per cent. of fine stuff in its measure, to one part of best Portland cement. Of course, these proportions are varied to meet various requirements.

The temporary centring is allowed to remain in position for from 10 to 15 days according to the class of work, weather, etc., and is lime-whited, washed with soap water, or covered with oiled paper, to prevent the concrete adhering to it.

The illustrations on pages 616 and 626 show the application of this system to dock work at Hunter's Point, Cal. The plans were prepared for the San Francisco Dry Dock Company. In the construction of this dock the entire chamber has been concrete-lined and reinforced with expanded steel, except for the sides of the approach, seat for the caisson and the apron arch, which are of cut granite masonry. The illustration on page 626 shows a small section of the side of the dock, and indicates the manner in which the expanded steel was used to bond the concrete sides. It should be mentioned



WHEEL PIT OF STEEL ARMOURED CONCRETE, IN PROCESS OF CONSTRUCTION.




SECTION OF WHEEL PIT.

that between the concrete lining and the rock surface, a thorough coating of damp proofing was used.

One of the most interesting combinations, from an engineering standpoint, which has been accomplished in steel-armoured concrete construction, is shown in the accompanying illustrations of a wheel pit, including an inlet arch, flume floor, generator floors and tail race. The sectional illustration shows the general form of the work. The wheel pit is 13 ft. in diameter, the inlet arch being 8 ft. in diameter. The tail race is a comparatively shallow conduit 15 ft. in width, and is covered by a segment arch formed of concrete and expanded steel. The photo reproduced on page 627 shows the wheel pit in course of construction. This system has also been successfully employed for fireproof floors, foundations, reservoir work, factory construction, bridges, sewage tanks, conduits and many other purposes.

# THE UGANDA RAILWAY.

By J. D. F. LEYLAND.

(*Continued from page 579 and concluded.*)

FOUR classes of engines were used, namely, A and E class engines, which were small and light, and used for shunting and stores work; N class, used for construction and railhead purposes; and F class, which have been specially constructed for the railway, and are very powerful. The A, E, and N classes were second-hand engines purchased from India. The total weight of engine and tender in A class is 17 tons, in E class 28·5 tons, in N class 36 tons, and in F class 50·1 tons.

### PLATE-LAYING.

The rate of plate-laying varied a great deal. The plate-laying gangs, when not hindered by heavy work, and when sufficient material could be brought up, were quite capable of doing one mile per day, and often did nearly one-and-a-half miles. The first party of coolies arrived from India in January, 1896, and in August of that year the Macupa temporary bridge from the island was completed, and plate-laying began on the mainland on August 5th, 1896.

The progress of plate-laying is calculated from this place and date.

| | Mile |
|---|---|
| On March 31st, 1897, railhead had reached | 40 |
| .. 1898, ,, ,, | 139 |
| .. 1899, ,, ,, | 279 |
| .. 1900, ,, ,, | 362 |
| .. 1901, ,, ,, | 483 |
| On Dec. 20th, 1901, ,, ,, | 584 |

Mile 584 is the terminus of the line at Port Florence. The average amount of plate-laying done in twelve months was about 106 miles. The temporary bridges were mostly trestle bridges.

### ROPE INCLINE.

The work on the permanent line for the descent of the escarpment into the Rift was very heavy, including several viaducts, and it was found necessary to construct at great cost a temporary rope incline, by which permanent way material could be lowered, pending the completion of the work on the Uganda line. In the House of Commons it was remarked that this rope incline was a great waste of money, and it was asked why it was built. Lord Cranborne, in replying, said that, by building the incline, we had reached the shores of the Lake at least twelve months earlier than we otherwise should have done; and that the railway was hurried on because two other Powers were competing with Great Britain for the possession of Uganda.

There were really four inclines, the total length of which was 6,040 ft., and the total descent 1,522 ft. The top incline was 1,570 ft. long, and fell 221 ft., and the steepest gradient was 1 in 7. The second incline was 1,150 ft. long, and fell 445 ft., the steepest gradient being 1 in 2·15. The third incline was 1,560 ft. long, and fell 695 ft., and the steepest gradient was 1 in 2. The bottom incline was 1,760 ft. long, and fell 161 ft., the greatest gradient being 1 in 6. Wagons could run down inclines 1 and 4 on their own wheels, but there were special carriers on inclines 2 and 3. An average of four wagons could go up and four down the inclines per hour.

### TRADE AND INDUSTRY OF THE COUNTRY.

The traffic consists mostly of merchandise exports, and imports, protectorate stores, live stock and passengers. The following are the chief commodities under the head of merchandise: ivory, grain and pulse, sugar,

provisions, building materials, and fruit and vegetables. With the coming of the railway the trade and industry of the country are improving wonderfully. In East Africa there is an abundance of ostriches, and there ought to be no difficulty in establishing ostrich farms. Indiarubber is plentiful. There is a great deal of pasture and arable land. In Uganda proper, manufactured articles of personal and agricultural use are much in demand. The export trade consists almost exclusively of ivory, but the Waganda, who are an intelligent people, are taking great pains to foster native products, and they are expert in iron working.

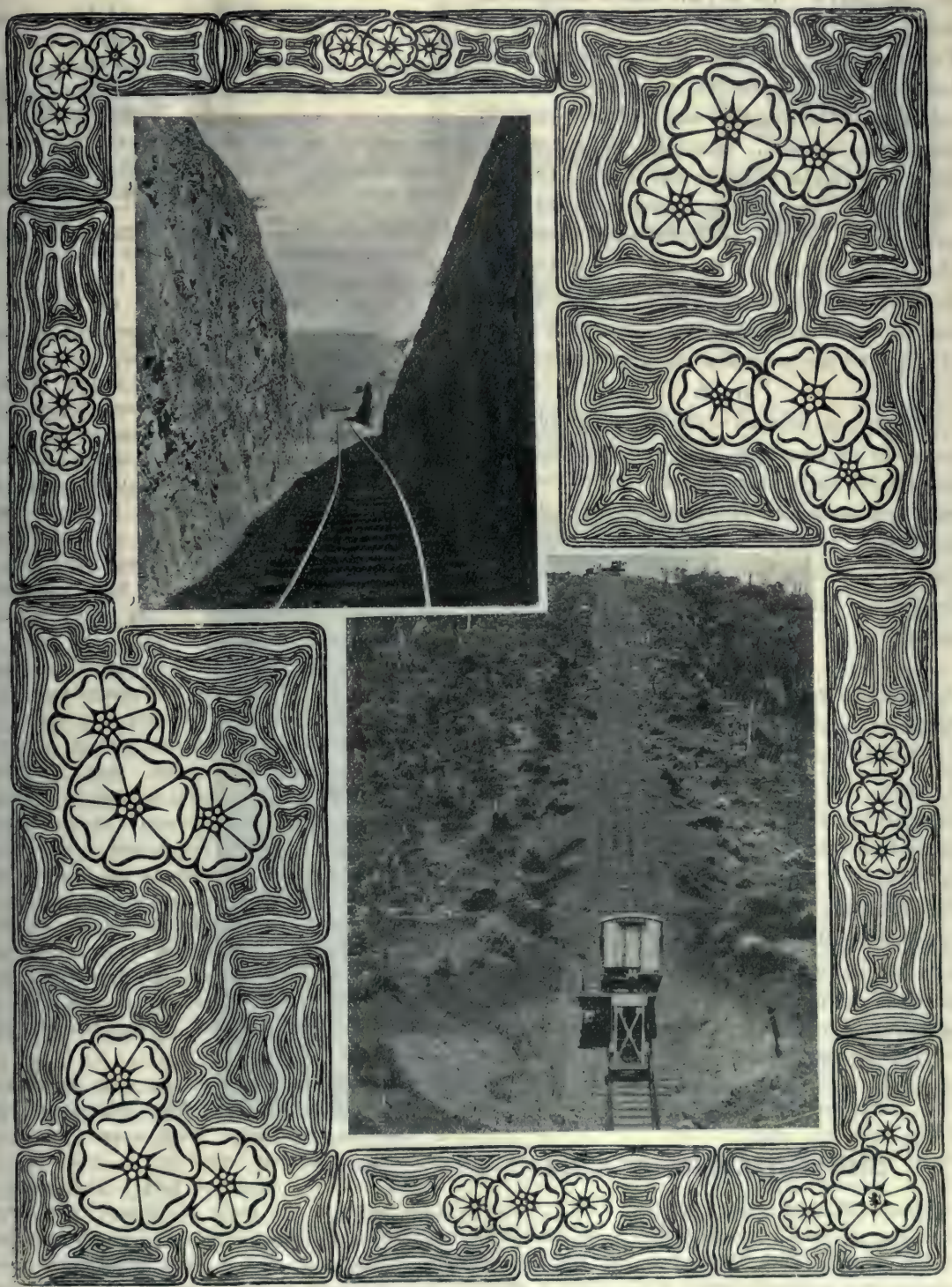
### COST.

In 1893 Major Macdonald estimated that the whole railway would cost £2,240,000, or £3,409 per mile. This estimate had to be prepared with very little knowledge of the country and its conditions, and without a proper survey being made. In 1899, when all the surveys had not been quite completed, the chief engineer estimated that it would cost £4,950,000, or £8,505 per mile. When the final surveys were completed, it was estimated that the total cost would be £5,550,000, or £9,503 per mile, which was a net increase of £600,000 over the estimate of 1899. (Details of the revenue accounts from the latest report appeared in the last issue, page 559.) There were four chief reasons for this excess. First, the chief engineer took the finished part of the line as a guide, but it proved to be much less difficult than the uncompleted part. Secondly, he had very imperfect knowledge of the climatic conditions of the country to be traversed, and in the two succeeding years there was a great



MEMBERS OF THE RAILWAY CONSTRUCTION STAFF.

The Manager and Chief Engineer, Sir George Whitehouse, K.C.B., is in centre of group (with dog). On the right in the following order are Mr. R. Anderson, C.M.G., Assistant Chief Engineer, Mr. B. Eastwood, Chief Accountant, Mr. C. Sandiford, C.B., Locomotive Superintendent (in light suit), and Mr. F. Rawson, C.B., Assistant Manager. Dr. Sieve King, the Medical Officer (with beard) is on the left of Sir George Whitehouse, K.C.B.



(1) Cutting at Mile 525, near Fort Ternan.

(2) View of temporary rope incline showing carrier nearing pit.

deal of heavy tropical rain which stopped all work. Thirdly, he took the price of stores from England to be the same as in previous years, but the rise in price of coal upset all calculations in this respect, and could not possibly have been foreseen. Fourthly, he was unable to foresee certain additional works, the advisability of them not becoming apparent until some time after the estimate was sanctioned. The under-estimate in the case of the Uganda Railway was not comparable with that in the case of the Manchester Ship Canal, and works of this kind are generally under-estimated.

**STAFF.**

The engineering staff of the line was as follows : one chief engineer, one chief assistant engineer, one chief draughtsman, one assistant draughtsman, two superintendents of works, seven district engineers, twenty-three assistant engineers, one locomotive superintendent, three assistant locomotive superintendents, one workshop manager.

Finally, it should be remarked that the Uganda Railway has not in any way brushed off the picturesque charm or wildness of the country, still less of the people through whose country it passes. It is not, even now, at all a humorous exaggeration to say that the wayside landscapes remind the traveller of that series of pictures in "Punch" entitled "Prehistoric Peeps." On the platforms naked savages, carrying elaborate ornaments, often including old jampots in the slits cut in their ears, peer and grin with good-natured curiosity at the uncanny objects which engineers have sent among them.

The accompanying illustrations are reproduced by the courtesy of the Foreign Office.

## SHIPBUILDING NOTES.

Messrs. William Gray and Co., Ltd., recently launched the steel screw steamer *Wavelet*, for Messrs. Needham Bros., West Hartlepool. She will take the highest class in Lloyd's, and is of the following dimensions : viz. : length over all, 342 ft. ; breadth, 46 ft. ; and depth, 24 ft. 4 in., with long bridge, poop and topgallant forecastle. The hull is built with deep frames, cellular double bottom, and large aft peak ballast tank, six steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large patent donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. The ship and machinery have been built under the superintendence of Mr. C. P. Sanderson on behalf of the owners.

The s.s. *Augusta*, built by Messrs. W. Dobson and Co., of Low Walker-on-Tyne, to the order of Mr. P. A. Gron, of Sandefjord, Norway, left the Tyne last week, for her official trial trip, after which she sailed on her maiden voyage. The vessel, which has been built to highest class Norwegian Veritas, is of the following dimensions : length between perpendiculars ; 338 ft. ; breadth, 48 ft. ; depth moulded, 28 ft. ; and has a dead-weight carrying capacity of about 6,000 tons. She is of the type of vessel of single deck class, with poop, bridge, and forecastle, and has been specially constructed for the owner's iron ore trade, between Norway and Rotterdam, with large deep tank for water ballast fitted amidships. Nine large steam winches are provided for dealing with the cargo. The propelling machinery, which has been constructed by the North-Eastern Marine Engineering Company, Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of their latest type of triple expansion surface condensing engines, having cylinders 24 in., 39 in., and 66 in., with 45 in. stroke, steam being supplied by three large steel boilers working at a pressure of 180 lb. per square inch. A good speed was maintained on the trial run and the engines worked without the slightest hitch. There were numerous visitors present during th run, including the owner, Mr. P. A. Gron, Mr. W. J. Jobling, and Capt. Christensen, under whose supervision the vessel and engines have been built, Mr. H. Dobson and Mr. W. Dobson, representing the ship builders, and Mr. J. Daglish, representing the engine builders.

There was recently launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principal dimensions being 123 ft. 6 in. by 22 ft. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of Messrs. The Grimsby Atlas Steam Fishing Company, Ltd. (Messrs. Letten Bros.), Grimsby, and is being fitted with powerful triple expansion engines by Messrs. Charles D. Holmes and Co., of Hull. She is replete with all the latest improvements for this class of vessel.

# OUR WEEKLY BIOGRAPHY.

## PROFESSOR JOHN OLIVER ARNOLD.

PROFESSOR JOHN OLIVER ARNOLD was born in 1858. He was educated at King Edward's Grammar School Birmingham, and on the conclusion of his studies there he was enrolled as a cadet on H.M.S. *Conway*, and subsequently joined the Royal Naval Reserve as a midshipman. When he reached the age of twenty he went to Sheffield and entered the Engineering Department of the Sheffield Steel and Iron Works, where, after he had gained experience in the laboratory and testing departments he became the firm's chief chemist and testmaster. His next appointment was at the Farnley Ironworks, Leeds. This was followed by two years as chemist and manager of the Spanish Steel Works, Sheffield, in which city he also practised as a consulting metallurgist and chemist.

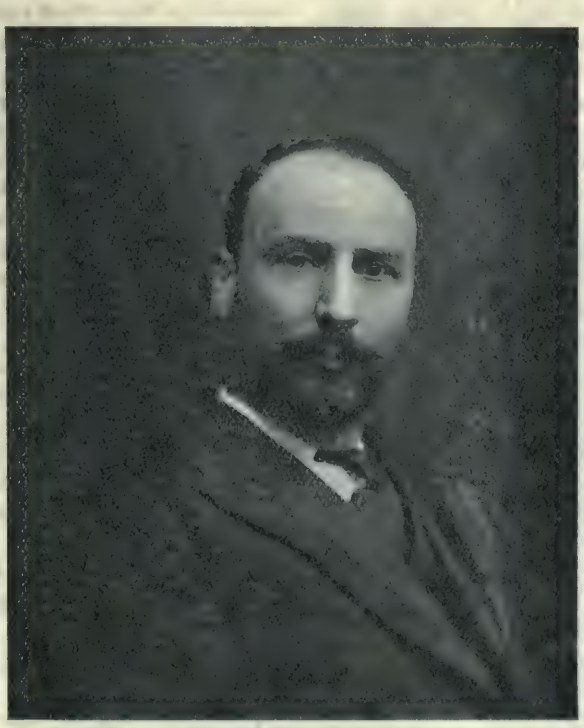


*Photo by Elliott and Fry.*

PROFESSOR JOHN OLIVER ARNOLD.

In 1887 the Institution of Civil Engineers awarded him the Telford Premium for his paper on the influence of chemical composition on steel tyres. Two years later he was appointed to his present position as Professor of Metallurgy at the University College of Sheffield, which was then known as the Sheffield Technical School. In 1895 he was again awarded the Telford Premium, and, in addition, a gold medal for his researches on the influence of carbon on iron. The Institution of Engineers and Shipbuilders in Scotland awarded him in 1898 a premium for his lecture on the internal architecture of metals, and quite recently the Iron and Steel Institute conferred upon him the Bessemer Gold Medal.

During the last two years Professor Arnold has been engaged in reorganising the steel and iron laboratory at the Sheffield University College, which promises to be one of the finest equipped institutions of its kind. It will contain a full-sized experimental plant which will serve to demonstrate the three standard methods of steel manufacture—crucible, Siemens and Bessemer. The scale upon which instruction has already commenced in this laboratory is exemplified by the fact that during the current session about forty tons of iron castings have been made from the new experimental 40-in. cupola. The motive power throughout is electricity; and the foundry is spanned by a 4-ton travelling crane.

Professor Arnold is one of the three technologists appointed as special lecturers to the British Association during the forthcoming visit to South Africa.

# NAVAL NOTES.



### GREAT BRITAIN.

THE month of March has been a very quiet one so far as launches are concerned, only the destroyer *Nith* and two submarines, *A8* and *A9*, having taken the water to date, all these on the 7th of the month. But in trials there has been much more doing, and apart from the *Carnarvon*, to which reference was made last week, the *Devonshire*, *New Zealand*, and *Pathfinder* have all entered upon the trial stage. The *Devonshire* at her one-fifth power trial made 13·07 knots, with 4,533 h.p., and a coal consumption approximating to 2 lb. per i.h.p. per hour.

Lord Brassey, in a paper read before the Institution of Civil Engineers last week pleaded for the construction for the British navy of more vessels of small displacement, vessels of from 10,000 to 12,000 tons burthen as heavily armed and protected as the larger vessels we are now building, but with less speed and smaller coal capacity. He pointed to the movement in this direction in the navies of France and Italy, and held that what those countries considered advisable could not be wholly disregarded by British naval administrators, and no naval country was so wealthy as to make unlimited appropriations to new construction.

### FRANCE.

Reports have been appearing in the papers to the effect that France has determined to abandon the construction of submarines and to build only submersibles for the future, but the reports are somewhat premature. It is true that the submarine *Z* has been found in comparative trials with the submersible *Aigrette* to be a very inferior type of vessel, but this is considered to be mainly due to the faulty design of the *Z*, and the opinion of French experts that the submarine can be largely utilised for defensive purposes, the submersible for offensive purposes is by no means changed, nor is there any intention of unifying the two types. What is proposed is that the displacement of the submersible classes should be increased to 400 tons, and that of the submarine designs to 100 tons.

### GERMANY.

Several more vessels are expected to take the water from the German yards this year, although a large number were got off the stocks in 1904. The principal vessels will be the battleships *O* (building at Stettin), and *P* (building at Wilhelmshaven), the armoured cruiser *C* (building at Bremen), and three protected cruisers, the *N*, *Ersatz Alexandrine* and *Ersatz Meteor*. These last-named vessels are building at the Weser Yard, at Kiel, and at Dantzic respectively.

### UNITED STATES.

The statistical data published on the subject of the construction of the battleship *Louisana* and *Connecticut* make very interesting reading. These two vessels are building, it will be remembered, at a private yard (the Newport News Company), and a public establishment (the New York Navy Yard). The results of the investigations held into the comparative rates of progress made by the two vessels show that whereas the private company has not made any special effort, and work on the *Louisana* has been performed in the regular way and under normal conditions, the Navy Yard has had to put forth unusual effort and energy to maintain the requisite rate of progress. The reasons for this are mainly industrial, it being held that higher rates of wages are paid at the Navy Yard than by private companies in Greater New York and elsewhere, and the rates of the latter average higher than companies elsewhere. Employment the year around is steadier and more secure than in private yards. The higher wages, shorter hours and steady employment attract the best grade of workmen to the Navy Yard, where a tacit recognition of an asserted economic theory prevails, that the best workmen cannot be induced to work extra hard without larger pay than the average. The following reasons are also stated: The expectation or belief that if the *Connecticut* was built in record time the building of another battleship would be given the Brooklyn Navy Yard; a zeal generated by the general challenge of the country to the Navy Yard workmen to make good their claims in this test; prompt discharge for inefficiency; dismissal of workmen who could not or would not come up to a required standard of output in quantity and quality; no restriction of output individually or collectively; loafing, soldiering or "marking time" not tolerated; workmen required to begin work the moment the whistle blows, and to continue working until the moment the whistle blows at quitting time; strict technical and exacting supervision of a high order of skill and experience; a desire on the part of naval constructors and workmen to remove an impression of inefficiency growing out of former Navy Yard construction of war vessels, before civil service regulations controlled employment there.

# 30-in. DUPLEX BORING AND TURNING MILL.

BY MESSRS. WEBSTER AND BENNETT, COVENTRY.

THE machine illustrated on this and the following pages is the latest double-boring mill constructed by Messrs. Webster and Bennett, of Coventry. It weighs 5 tons 13 cwt., and has been designed to occupy a minimum of space. The advantages of an arrangement which enables one man to keep two tools working to their full extent are of course obvious. The machine can be used for work up to 30 in. diameter by 18 in. deep. The accompanying line drawings illustrate the more interesting points in construction, and the firm's explanatory notes upon these are given below.

The driving cone pulleys are at the back, and their axes are parallel to the greatest length of the machine, thus enabling the mill to be fixed in line with the main shop shafting, instead of at right angles to it, as is sometimes necessary. The driving gear is mounted inside the base, and works in either single or treble ratio, thus giving power for heavy cutting. The change of gear is made by handles at the front, which control friction clutches of the toggle expanded ring type, by means of which the speed of the heavy tables may be changed instantly and without shock. This change, together with two speeds on each countershaft, gives four speeds of table without shifting the cone belt.

Fig. 2 shows section of the spindle and bearing. A large spur gear is secured to the underside of the face-plate or chuck. This form of gear, which is 30 in. diameter, and is driven by a pinion, is preferred to bevel driving, as there is with it no tendency to lift the spindle. The pressure ring is directly under the spur gear, and runs in oil. This ring is supported by a column of metal carried straight from the floor line, and imparts a degree of solidity which is specially valuable when dealing with

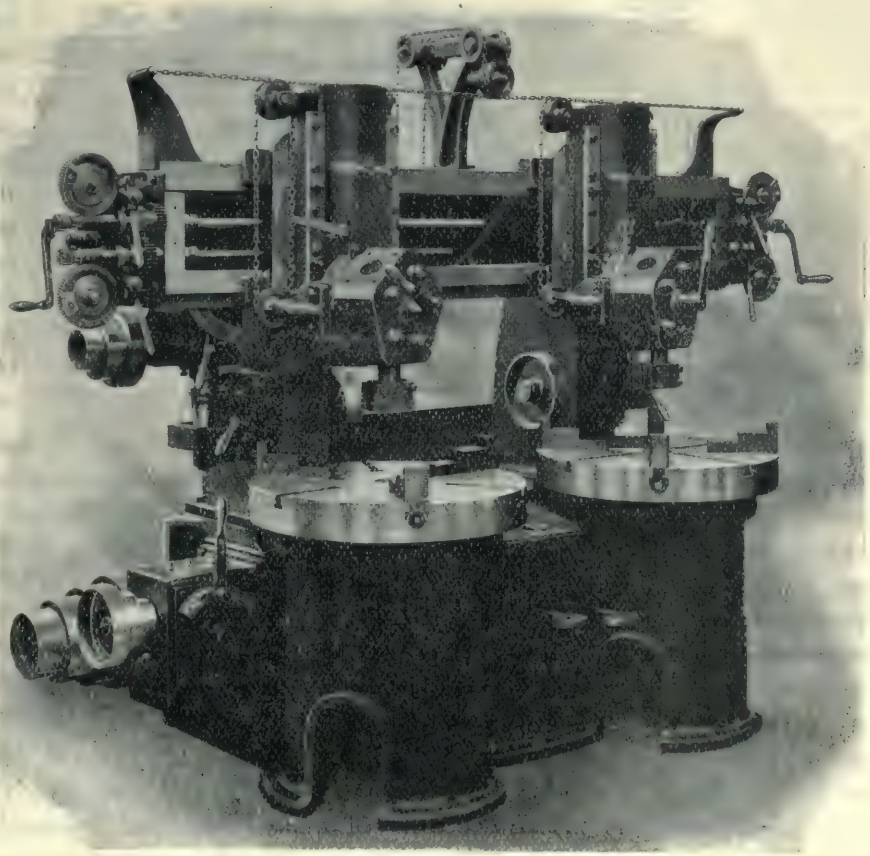


FIG. 1. 30-IN. DUPLEX BORING AND TURNING MILL.

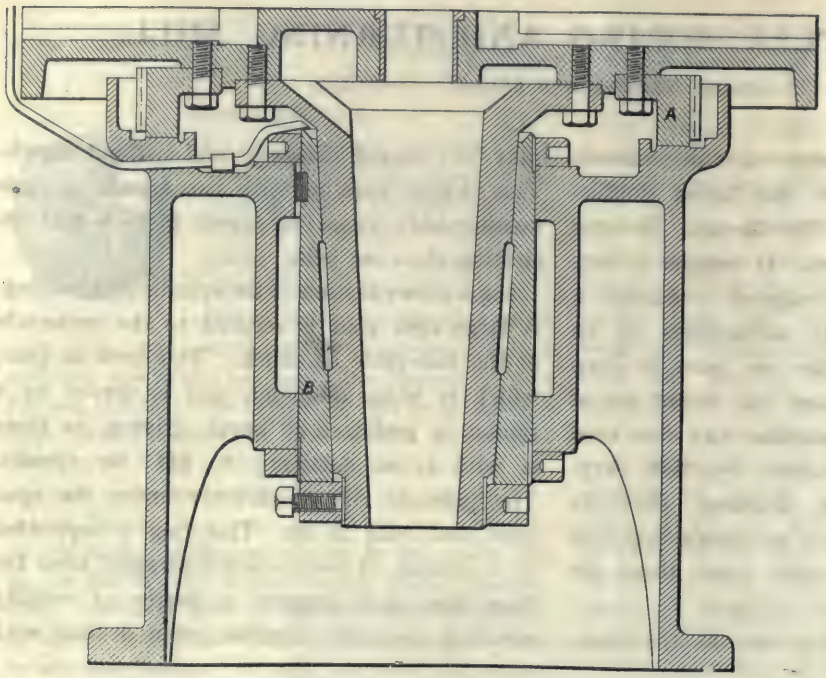



FIG. 2. SECTION OF SPINDLE AND BEARING.

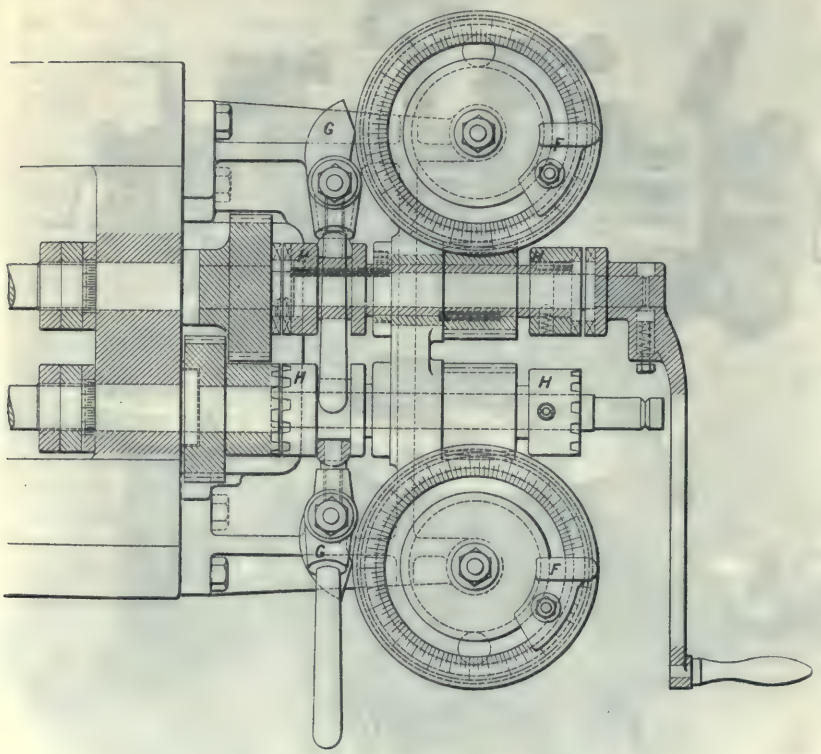



FIG. 3. AUTOMATIC TRIP MOTION.

heavy work. The spindle itself has therefore to take the side thrust only. It is bolted directly to the face-plate, and runs in a long conical bush B, which may be adjusted by nuts top and bottom. The oil reservoirs can be filled without disturbing any work or fixtures on the face-plate. The cuttings fall through the spindle. Bushes for boring bars may be inserted in the face-plate.

The feed motion (fig. 4) is driven by a three-speed cone pulley. A quick movement by means of a hand lever C is provided for use when changing from roughing to finishing, and saves the necessity of shifting the belt when the most suitable speed has been fixed upon. This simple arrangement is preferred by many users to more complicated gears giving a long range of feeds.

The vertical feed shaft at the back of the cross slide is capable of being driven slowly when a cutting feed is required, and quickly when the slides are to be returned or advanced. The cutting feed is driven by the cone pulley, and worm gear D. The power quick return

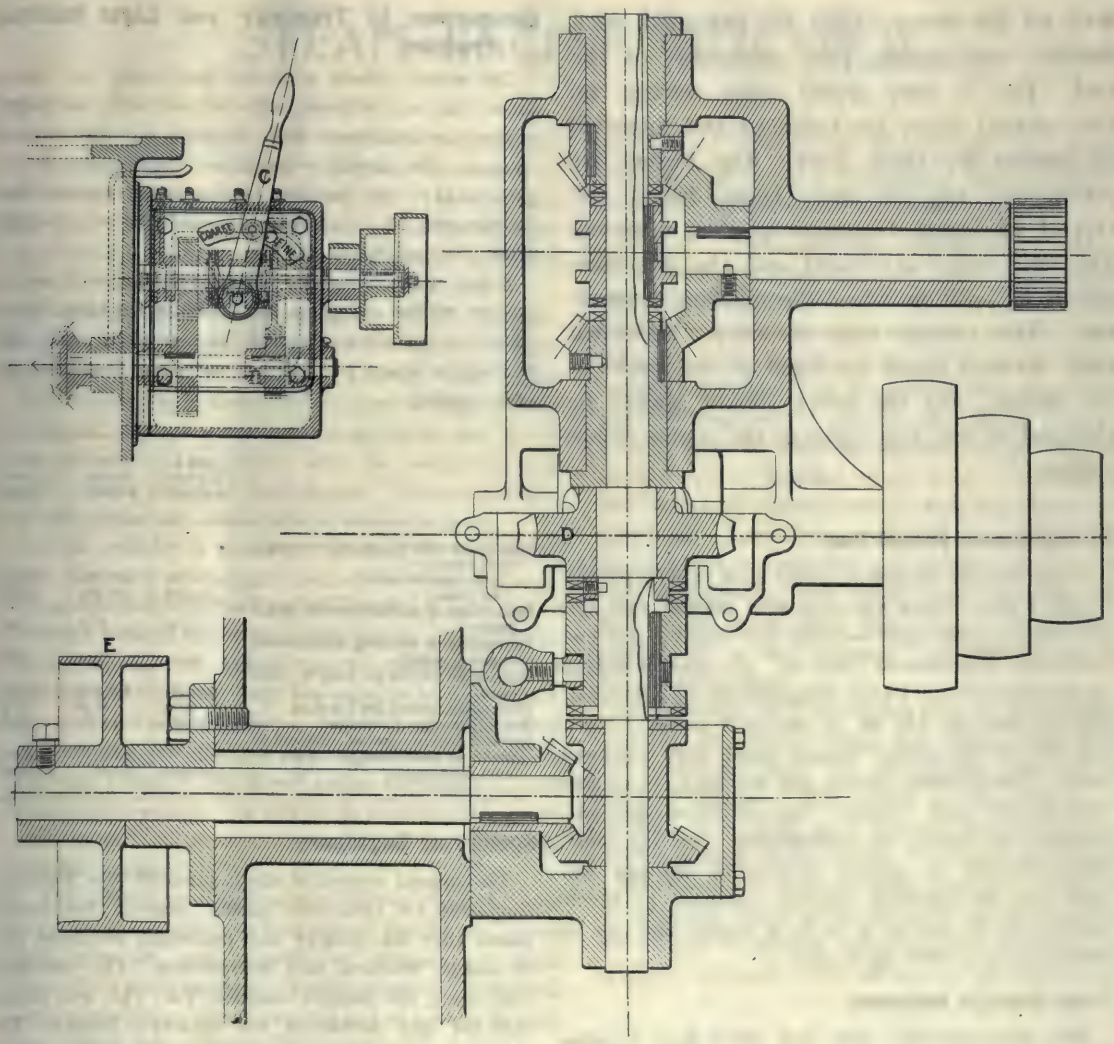



FIG. 4. FEED GEAR.

is driven by the pulley E, which is belted directly to the countershaft, and runs at a constant speed. The clutch which controls this motion is operated by a hand lever. The direction of the travel of the slides is reversed at will by means of the bevel wheel and pinion seen at the top of the section. The motion is delivered to the gearing at the end of the cross slide by the pinion at the end of the bevel wheel shaft. This motion, it may be remarked, is a patented feature of the machine.

Fig. 3 shows the automatic trip motion. The trip dogs F are carried by worm wheels, whose movements always bear a fixed relation to the tool. At the termination of the cut the dogs strike the lever G, which withdraws the clutch from the feed gear. This sliding clutch H is double-ended; the teeth on the one end engage with the feed gear, and those on the other end with the crank handle. The whole clutch, however, is not long enough to engage both ends at once. By this means the crank handle always hangs stationary when the automatic feed or the power quick return is in action, thus saving any risk of accident if the operator neglects to remove the crank. The

dials on the worm wheels are indicated, each division representing $\frac{1}{8}$ in. movement of the tool. This is very useful when setting up. The vertical slides are balanced and mounted on swivels for taper work. The turrets are pentagonal, the flat faces being drilled and tapped to secure tool-holders when required. The large holes are bored and the flat faces milled in position when the machine is under test. This ensures their accuracy. Hardened steel division plates are fixed to the backs of the turrets, but the latter should always be clamped by the bolt through the centre before cutting.

### United States Parcel Post.

Those who are frequently called upon to send parcels to the United States will note with interest that the new official parcel post between that country and our own comes into force on April 1st. The limit of weight for parcels from the United Kingdom will be 4 lb. 6 oz., and the postage will be 2s. for each parcel. There will be no non-postal charges apart from Customs duty. The insurance system will not apply to parcels sent by the new service. This official service will, however, be carried on concurrently with the semi-official service at present maintained through the agency of the American Express Company, by which parcels can be sent up to 11 lb. in weight, and can be insured for any value up to £120.

### Tube Scheme Deferred.

The Hammersmith, City, and North-East London Railway Bill was recently before the House of Commons Committee on Standing Orders, the proposal being to construct an electrical tube line from Hammersmith to the City, whence branches would communicate with Palmer's Green and Walthamstow. The estimated cost of the line, about twenty miles in length, was £6,000,000. The Examiner of Standing Order Proofs reported instances in which there had been non-compliance with standing orders. The promoters appealed for a dispensation, but the committee, after deliberation, decided not to recommend that the standing orders should be dispensed with. The effect of this decision is that the Bill will not proceed during the present Session of Parliament.

A correspondent seeks information as to method of calculating ratios obtainable in epicyclic gearing for change speed gear on motor-cars.

### Comparison in Tramway and Light Railway Practice.

The annual return of capital and traffic for 1903–4 shows that, as compared with the year 1878, the length of line has increased from 269 miles to 1,840 miles in 1903–4; the capital expenditure from £4,207,350 to £46,451,444; the number of passengers carried from 146,000,000 to 1,799,000,000; and the net receipts from £230,956 to £2,912,110.

A few of the ratios and percentages derived from the present return are given in the following table, which relates to an electric period, as compared with 1898 (maximum steam period), and 1879 (an almost wholly horse period):—

| — | 1903-4. Electric Period. | 1898. Steam Period. | 1879. Horse Period. |
|---|---|---|---|
| Capital expenditure per mile of single track open:— | | | |
| Lines and works ... ... ... | £11,780 | £7,770 | £7,840 |
| All items ... ... ... ... | £16,018 | £10,469 | £9,877 |
| Percentage of net receipts to capital outlay ... ... ... ... ... | 6·27 | 6·38 | 3·97 |
| Percentage of working expenditure to gross receipts ... ... ... | 66·15 | 76·93 | 83·81 |
| Passengers carried per mile of route open ... ... ... ... ... | 977,951 | 806,703 | 469,641 |
| Passengers carried per car mile ... | 9·23 | 9·48 | 7·77 |
| Average fare per passenger ... ... | 1·11d. | 1·23d. | 1·84d. |
| Amount paid in relief of rates out of profits of undertakings worked by local authorities ... ... ... | £207 087 | (Not given) | (Not applicable) |

### Society of Engineers.

The annual report of the Council of the Society of Engineers for 1904—the jubilee year of the Society states that the Society has materially advanced alike in status, finances, and membership. On December 31st, 1904, the number enrolled, viz., 550, was greater than at any period in the Society's history. This total is the more gratifying as the losses from death, resignation, and other causes during the year amounted to thirty. The number of members and associates elected during the year reached the satisfactory total of forty. The Council report that Mrs. Williams, who died on December 2nd, 1904, bequeathed to the Society the portrait in oils of her late husband, Mr. Alfred Williams, one of the founders of the Society, who for forty years was its Honorary Secretary and Treasurer. The portrait has been placed in the collection of portraits of Past-Presidents in the Society's Offices, as requested by Mrs. Williams in her will. The Council have awarded premiums to the following authors of papers: Mr. W. Edward Storey, President's Gold Medal; Mr. R. G. Allanson-Winn, Bessemer Premium of Books; Mr. A. S. E. Ackermann, Society's Premium of Books; Mr. Frank Latham, Society's Premium of Books.

# STEAM ENGINE RESEARCH.

AT the last meeting of the Institution of Mechanical Engineers a notable paper was presented by Professor David S. Capper, being the "First Report to the Steam Engine Research Committee," and incorporating the results of experiments extending over six years on jacketed and unjacketed cylinders.

A special engine was obtained from Messrs. Marshall, Sons and Co., of Gainsborough, and erected in the Engineering Laboratory at King's College. The engine thus obtained is a horizontal compound engine. The cylinders, which are side by side, are 6½ in. and 11¼ in. diameter, by 14 in. stroke, and the connecting rods drive cranks placed at right angles. The arrangement of the engine and connections is shown in fig. 1.

Each cylinder is separately jacketed on the barrels and the ends, the supply and drain from the ends being separate from that for the barrel. Each cylinder is fitted with a Meyer expansion valve, adjustable by hand, so that the cut-off can be separately varied between one-quarter and five-eighths of the stroke. By grid valves on admission and exhaust sides, either cylinder can be arranged as a simple engine, and by blocking either of the Meyer plates the engine can be made single-acting. In any of its varied adjustments the engine is as nearly as possible an ordinary commercial engine.

The boiler available was a Davey-Paxman semi-portable locomotive working up to 150 lb. per square inch pressure, and capable of evaporating about 1,000 lb. of water per hour. The condenser is a cylindrical copper condenser with 50 square feet of cooling surface, the tubes being externally cooled.

### SCHEME OF EXPERIMENTS.

The committee decided that the first series of trials should be made with the engine arranged as a single-cylinder high-pressure engine, non-condensing jacketed, the second series being a repetition of the first series but without jackets. Ater a careful study of previous experiments, it was further determined that the variables should be temperature and speed; cut-off, and all other conditions being kept constant. Temperatures of 245 deg. F., 280 deg. F., 315 deg. F., and 350 deg. F., were chosen, so as to give equal intervals between successive trials of the series. These temperatures correspond to about 27, 49, 84, and 135 lb. per square inch absolute respectively, at the engine steam-chest. The chosen speeds were 50, 100, 150, 200, and 250 revolutions per minute, corresponding to piston speeds of about 117, 334, 350, 467, and 584 ft. per minute respectively. For reasons stated in the paper, it was not found possible to adhere absolutely to these speeds and temperatures.

### THE LEAKAGE PROBLEM.

Attention was particularly directed to the question of leakage through the slide valve, or piston, to the exhaust, which, of course, would not be shown on the expansion curve of the indicator diagram. Messrs. Callendar and Nicholson have shown that such leakage may be considerable, and in the present trials an attempt has been made to measure, analyse, and allow for the various leakages which occur. On analysing the results of experiments in this connection, it is found that under given conditions the leakage when the barrel of the cylinder was warmed by the jacket was considerably less than when it was cold. And it is shown that the proper correction to employ will be that obtained with the cylinder ends and barrel warmed.

In all except the 50 revolution trials there is a distinct reduction in leakage when the sliding surfaces are well lubricated, over the corresponding leakage with scant lubrication. This effect is not, however, so constant or so large as to warrant any definite quantitative analysis of the results. The cases in which such a reduction was observed were, however, so numerous in individual trials as to definitely prove that where the oil film is uniform and continuous leakage is appreciably reduced. The curves on fig. 2 show this

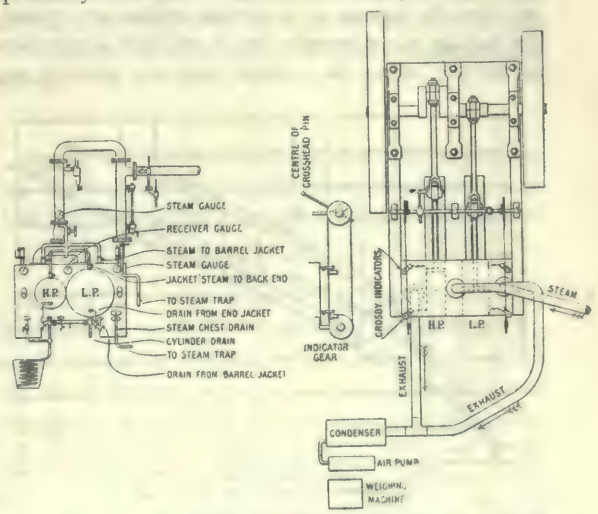



FIG. 1. SHOWING ARRANGEMENT OF ENGINE AND CONNECTIONS.

clearly, although the reduction diminishes with increase of pressure. It is interesting to note on the curve for the well-lubricated jacketed trials that where in one instance the lubrication failed the leakage at once runs into and above the curve for scant lubrication.

### EFFECT OF PRESSURE UPON LEAKAGE.

The leakage, as would be anticipated, rises with an increase of pressure between steam-chest and exhaust. Where the valve is stationary in mid-position the leakage increases approximately as the pressure. Where the engine is running, however, the leakage does not increase so rapidly as the pressure, and the higher the speed the larger does this divergence become. It is evident that this bears a striking resemblance to the laws governing condensation and re-evaporation on the cylinder walls of steam engines, and when the amount of the leakage and its reduction by jacketing is considered, the conclusion arrived at by Messrs. Callendar and Nicholson is irresistible, that, much of the leakage must be in the form of moisture condensed on the valve face and re-evaporated as it passes over into the exhaust.

As bearing upon the above point experiments were made to determine what effect wire-drawing, and therefore superheating the steam previously to its entering the steam-chest, has upon leakage, and a table drawn up showing a reduction of about 25 per cent. in the leakage if wire-drawing to the extent indicated in the table be resorted to.

There is considerably less leakage when the engine and therefore the valve is stationary in mid position, but when the valve is moving there is appreciably less total leakage per hour when the engine is making 250 over the leakage at 50 double strokes per minute. The leakage is consistently less at the high speeds than at the low, where the cylinder walls are jacketed and

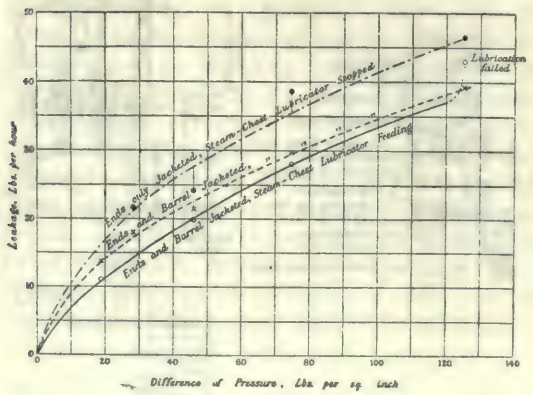



FIG. 2. CURVES SHOWING EFFECT OF LUBRICATION ON LEAKAGE.

the surfaces lubricated. This may partly be due to a more perfect spreading of the oil film at the higher speeds, or it may be due to the reduced time allowed for condensation and re-evaporation, or to a combination of the two. This clearly demonstrates that leakage was not in the present instance produced by the lifting of the valve in working, but by a more or less steady flow of moisture or steam between the valve and slide-face. The persistent and considerable difference between the leakage, when the engine is still with the valve in mid-position and when it is running, points strongly to the conclusion that the amount of overlap and its variation has an important effect upon the leakage.

The leakage is not directly proportional to the pressure for all speeds, and there is reason to doubt whether it is exactly inversely proportional to the overlap. But these assumptions are sufficiently accurate if suitable values of the factor are introduced to enable an approximate correction for leakage to be made by their aid.

### PERCENTAGE OF LEAKAGE.

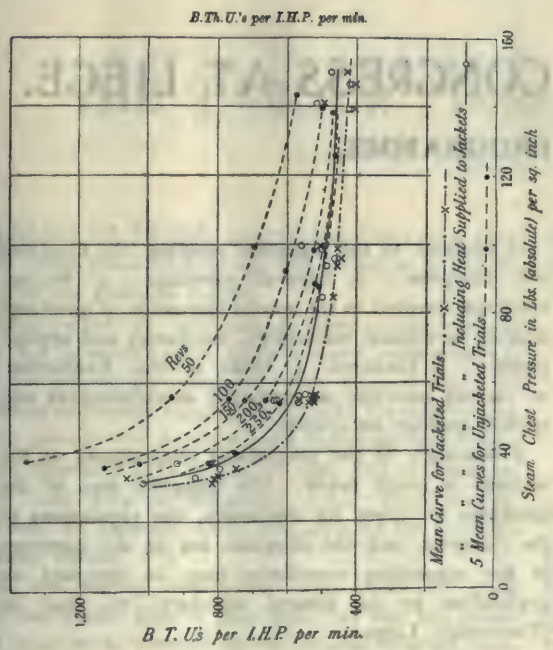
It is found that the leakage, under given conditions of pressure, is equal to a maximum of 20 per cent. of the total steam used down to a minimum of 4 per cent. It is therefore in no case negligible.

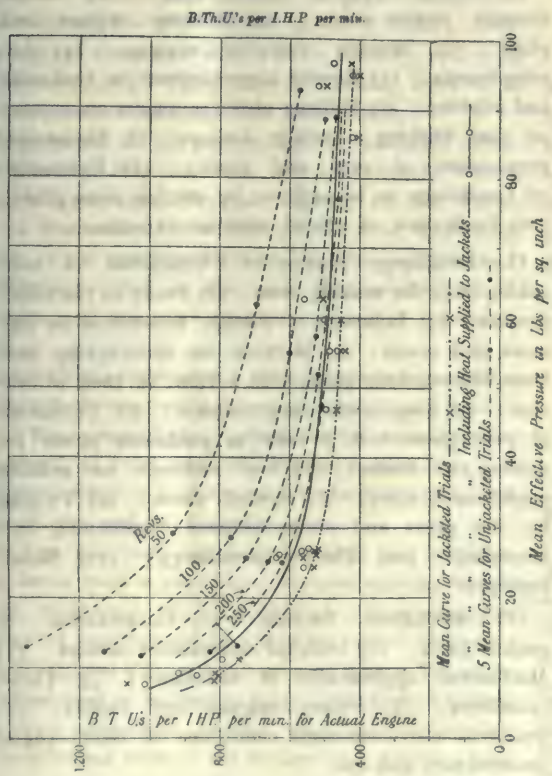
The leakage through the piston was measured by blocking the port at one end of the cylinder and running the engine single-acting. Cards of the working and blocked ends were also taken. It was found that the piston leak was independent of revolutions per minute, and was proportionate to the admission pressure and area of indicator diagram on the working side of the piston. The piston leak was found at its worst to be less than 2 per cent. of the steam consumption of the engine.

### SOME RESULTS OF THE EXPERIMENTS.

It has been shown that for an unjacketed engine with a given ratio of expansion, initial condensation, expressed as a percentage of the steam in the cylinder, diminishes with increase of initial temperature, while the total condensation per stroke increases with such temperature increase. This, though suggested by Messrs. Callendar and Nicholson's researches, has never previously been demonstrated with clearness, as if leakage is not allowed for, the results are obscured and even reversed, and the conclusions arrived at without leakage allowance are therefore unreliable.

Also it appears from the results here obtained that the re-evaporation for a given ratio of expansion is as great and sometimes greater without jackets than with them. This shows very clearly that the regenerative action of the cylinder walls with a given ratio of expansion is largely independent of their mean




FIGS. 3 AND 4. RESULTANT CURVES SHOWING TEMPERATURE AND PRESSURE AT WHICH JACKETS CEASE TO BE ECONOMICAL.

temperature. No quantitative analysis of re-evaporation is possible where leakage is not taken into account, as without the necessary allowance results would be largely illusory.

Further, it is possible from the results obtained to show the temperature when for any speed of revolution with a given rate of expansion the jackets will here become unnecessary or wasteful. If the heat units per i.h.p. per minute required by the unjacketed engine for each speed of the series be plotted either on an initial pressure or a mean effective pressure base, the points for each speed will be found to lie on four curves, which become closer and closer to one another as the speed increases, and all converge to a point as pressure or temperature increases. If the heat consumption for the jacketed series be likewise plotted, it will be found that the points for the different speeds at each pressure lie irregularly round a point, their exact position being determined by the accidentally slight variations of the conditions of each trial. A fair curve through the means of these points will lie below the corresponding curves for the unjacketed trials, but if the heat absorbed in the jackets be included the resultant curve cuts the unjacketed curves at points which for each speed indicate the temperature and pressure at which the jackets cease to be economical. Such curves are shown in figs. 3 and 4. The resultant mean for the jacketed trials, cuts both the 250 and the 200 revolution unjacketed curves within the temperatures and pressures included within the scope of the present experiments, and the temperatures and pressures where the 150, 100, and even the 50 revolution curves would cut, can very closely be predicted. As far as the author is aware, this is the first time when an exact determination for a given engine and ratio of expansion of this point has been diagramatically shown.

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The British Science Guild has appointed the following officers: Sir Norman Lockyer, president; Lord Avebury, hon. treasurer; Lady Lockyer, hon. assistant treasurer, and Mr. C. Cuthbertson, hon. secretary.

Mr. Arthur Peckett, of Bristol, has joined Mr. Herbert W. Umney, A.M.I.E.E., M.I.Mech.E., Assoc.M.Inst.C.E., in partnership at 46, King William Street, E.C., where the firm will carry on the business of civil, mechanical and electrical engineers, merchants and agents. They will also represent Messrs. Isaac Storey and Sons, of Manchester; The Sunderland Forge and Engineering Co.; Messrs. Rubery and Co., of Darlaston; Messrs. Pollock, Whyte and Waddel, of Johnstone, N.B.; and Messrs. J. and O. G. Pierson, of Paris.

# THE INTERNATIONAL CONGRESS AT LIEGE.

## PROVISIONAL PROGRAMME.

AS already announced, an International Congress of Mining, Metallurgy, Mechanics and Applied Geology will be held in connection with the Liége Universal Exhibition, from June 26th to July 1st.

The Council of the Congress Organising Committee comprises the following: President, M. Jules Magery, Past President of the Liége Engineers' Association; Vice-Presidents: M. Alfred Habets, Professor of Mine Working and of Industrial and Commercial Geography at the Liége University, President of the Liége Engineers' Association, President of the Mining Section; M. Adolphe Greiner, General Manager of the Société Cockerill, Seraing, President of the Metallurgy Section; M. Herman Hubert, Professor of Applied Mechanics and of Industrial Physics at the Liége University, President of the Mechanical Section; M. Max Lohest, Professor of Geology at the Liége University, President of the Applied Geology Section. General Secretary, M. Henri Dechamps, Professor of Industrial Architecture and Machine Construction at the Liége University. Assistant General Secretary, M. Paul Habets, Manager of the Espérance and Bonne-Fortune Colliery, Professor of Mine Working at the Brussels University. Secretary-Treasurer, M. J. Libert, Ingénieur-en-chef Directeur des Mines, Liége. Secretaries: M. René Henry, Engineer at the Hasard Colliery, Secretary of the Mining Section; M. Constant Renson, technical Director at the Angleur Steelworks, Secretary of the Metallurgy Section; M. Georges Duchesne, Engineer, Liége, Secretary of the Mechanical Section; M. René d'Andrimont, Secretary of the Liége Engineers' Association, Secretary of the Applied Geology Section.

Members of the Congress comprise: (1) Donors of at least a hundred francs (£4); and (2) Subscribers of twenty-five francs (£1). Donor members receive all the publications of the Congress. Subscriber members must enter their names for the section of which they desire to receive the publications. The twenty-five francs (£1) subscription only gives right to the publications of a single section; but the member's name may be entered in another section for an additional subscription of five francs (4s), which will give right to receive the publications of that section.

In addition to the inaugural meeting, the Congress will comprise: 1. General meetings. 2. Section meetings, devoted to the special discussion of questions relating to mining, metallurgy, mechanics and applied geology. 3. Lectures. 4. Visits to the Exhibition, to various scientific or industrial establishments and applied geology excursions.

A summary of the provisional programmes of the sections is given below. The complete text of the questions set down for discussion, the regulations of the Congress, and the complete list of the members of the organising committee, may be obtained on application to the general secretary, 16, Quai de l'Université, Liége.

I.—Mining Section. (1) Sinking deep shafts through sterile rocks; (2) Winding engines and plant; (3) Modern pumping engines; (4) Air-compressors; (5) Recent improvements in timbering and gobbing; (6) Shifting of the measures consequent on coal working; surface damage; (7) Mechanical preparation of ores and coals; (8) Firedamp; (9) Conditions to be satisfied by electric mine plant; (10) Unification of official mineral statistics.

II.—Metallurgy Section.—(1) Utilisation of non-caking coals for making coke; (2) Study of the blast-furnace; (3) Influence of foreign substances on pig-irons and steels; (4) Methods for intercepting dust from blast-furnace gases with a view to their utilisation; (5) Slag bricks and cements; (6) Utilisation of poor gases with a view to producing power for driving roll-trains; (7) New methods for making open-hearth steel; (8) Special steels; (9) Forging by the press and steam-hammer; hardening and annealing; (10) Electro-metallurgy; (11) Metallography.

III.—Mechanics Section.—(1) Construction of engine parts; (2) Internal combustion motors; (3) Mechanical applications of electricity; (4) Turbo machines; (5) Steam engines and boilers; (6) Practical and economical conditions of motor-wagon construction and use.

IV.—Applied Geology Section.—(1) Tectonics of coal basins; (2) Sedimentary deposits; (3) Metalliferous lodes; (4) Hydrology.

# THE LABOUR MARKET IN FEBRUARY.

BOARD OF TRADE returns just issued show that employment in February was better on the whole than in the previous month.

Employment in coal-mining during the month was fair generally, and showed some improvement, on the whole, as compared with a year ago. At collieries employing 534,664 workpeople, the pits worked on an average 5·31 days per week during the four weeks ended February 25th, compared with 4·95 in January, 1905, and 5·19 in February, 1904. Employment, however, in January, 1905, was affected by holidays to some extent.

In iron mining employment also continued good and was better than a year ago. At the 122 mines and open works covered by the returns received from employers, the average number of days worked per week during the four weeks ended February 25th was 5·90 as compared with 5·41 in January, and 5·79 in February, 1904. The number for January, however, is reduced by Christmas and New Year holidays.

Employment in the pig iron industry continued to improve during February and was considerably better than a year ago. Returns relating to the works of 108 ironmasters show that 311 furnaces, employing about 22,140 workpeople, were in blast at the end of February, 1905, or five more than at the end of January, and ten more than at the end of February, 1904.

Shipbuilding employment, though still dull generally, continued to improve and was better than a month ago. The percentage of trade union members unemployed at the end of February was 11·5, as compared with 12·4 at the end of January, 1905, and 12·6 at the end of February, 1904.

At iron and steel works employment was considerably better than a year ago. Returns relating to 202 works, employing 88,173 workpeople, show that the volume of employment in the week ended February 25th, 1905, was 4·6 per cent. greater than in the corresponding week of February, 1904. Taking the numbers employed according to the departments specified in the following table, it will be seen that there has been an increase in all branches, except in the Bessemer converting department, where a slight decrease is shown. The average number of shifts worked likewise shows an increase in all departments except one (founding) and is greatest in puddling forges, where it amounts to 5 per cent.:—

| Department. | Numbers employed in week ended | | | Average Number of Shifts worked per man in week ended | |
|---|---|---|---|---|---|
| | Feb. 25th, 1905. | Feb. 27th, 1904. | Increase (+) or Decrease (−) in 1905. | Feb. 25th, 1905. | Feb. 27th, 1904. |
| Open-Hearth Melting Furnaces ... | 7,777 | 7,631 | + 146 | 5·89 | 5·86 |
| Bessemer Converters ... ... ... | 2,238 | 2,318 | − 80 | 5·04 | 4·95 |
| Puddling Forges ... ... ... ... | 9,527 | 9,487 | + 40 | 4·80 | 4·57 |
| Rolling Mills ... ... ... ... | 28,672 | 28,112 | + 560 | 5·23 | 5·16 |
| Forging and Pressing ... ... ... | 3,453 | 3,424 | + 29 | 5·49 | 5·42 |
| Founding ... ... ... ... . | 9,279 | 9,145 | + 134 | 5·78 | 5 80 |
| Other Departments ... ... ... | 9,398 | 8,900 | + 498 | 5 81 | 5·72 |
| Mechanics and General Labourers ... | 17,829 | 16,458 | +1,371 | 5·74 | 5·70 |
| Total ... ... | 88,173 | 85,475 | +2,698 | 5·49 | 5·41 |

Employment in engineering trades, though still dull, was better than a month ago, and about the same on the whole as a year ago. The percentage of trade union members who were unemployed at the end of February was 6·4, as compared with 7·0 at the end of January, and 6·5 at the end of February, 1904. The percentages for the various districts are shown in detail in the following table:—

| District. | No. of Members of Unions at end of Feb., 1905, included in the returns.* | Percentage returned as Unemployed at end of | | | Increase (+) or Decrease (−) in percentage unemployed for Feb., 1905, as compared with a | |
|---|---|---|---|---|---|---|
| | | Feb., 1905. | Jan., 1905. | Feb., 1904. | Month ago. | Year ago. |
| North-East Coast ... ... | 12,993 | 5·7 | 5·4 | 5·1 | + 0·3 | + 0·6 |
| Manchester and Liverpool District | 17,912 | 8·5 | 8·1 | 6·9 | + 0·4 | + 1·6 |
| Oldham, Bolton, and Blackburn District | 11,555 | 10·5 | 11·8 | 11·1 | − 1·3 | − 0·6 |
| West Riding Towns ... ... | 11,691 | 9·0 | 9·2 | 8·2 | − 0·2 | + 0·8 |
| Hull and Lincolnshire District | 3,491 | 4·6 | 6·2 | 8·4 | − 1·6 | − 3·8 |
| Birmingham, Wolverhampton, and Coventry District | 6,363 | 4·0 | 4·7 | 4·3 | − 0·7 | − 0·3 |
| Notts, Derby, and Leicester District | 4,052 | 11·0 | 11·1 | 5·6 | − 0·1 | + 5·4 |
| London and Neighbouring District | 12,014 | 4·6 | 4·4 | 4·6 | + 0·2 | ... |
| South Coast ... ... ... | 4,090 | 3·1 | 2·2 | 2·1 | + 0·9 | + 1·0 |
| South Wales and Bristol District | 6,492 | 3·5 | 2·9 | 3·6 | + 0·6 | − 0·1 |
| Glasgow and District ... | 13,949 | 7·3 | 8·5 | 9·3 | − 1·2 | − 2·0 |
| East of Scotland ... ... | 3,617 | 10·5 | 12·1 | 10·1 | − 1·6 | + 0·4 |
| Belfast and Dublin ... ... | 3,458 | 9·8 | 13·2 | 8·1 | − 3·4 | + 1·7 |
| Other Districts ... ... | 5,575 | 5·1 | 5·1 | 5·0 | ... | + 0·1 |
| **United Kingdom** (Including certain Unions for which district figures are not available) | 143,934 | 6·4 | 7·0 | 6·5 | − 0·6 | − 0·1 |

# FLAT-BOTTOMED RAILWAY RAILS.

## STANDARD SPECIFICATION.

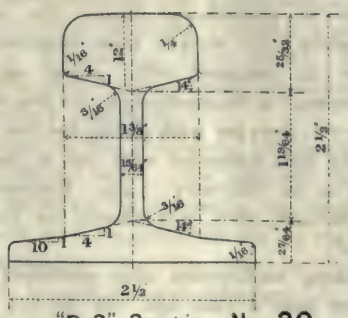
FROM Mr. Leslie S. Robertson, M.Inst.C.E., Secretary, we have received the Engineering Standards Committee's standard specification and sections of flat-bottomed railway rails. The thanks of the Committee are tendered to the members of the Railway Engineers' Association for their co-operation in the preparation of this report, and in particular to Mr. James C. Inglis and Mr. G. L. Eyles for the various series of standard flat-bottomed rails.

The following is a list of members of the Committee on Rails: Sir John Wolfe Barry, K.C.B., Chairman; Mr. F. R. Upcott, C.S.I., representing the India Office; Sir W. Shelford, K.C.M.G., and Mr. G. L. Eyles, C.M.G., representing the Crown Agents for the Colonies; Mr. Charles F. Wike (City Surveyor, Sheffield) and Mr. W. Harpur (Borough Engineer, Cardiff), nominated by the Incorporated Association of Municipal and County Engineers; Mr. Stephen Sellon nominated by the Light Railways and Tramways Association; Mr. J. Wilson (G.E.R.) and Mr. W. B. Worthington (L and Y.R.), nominated by the Railway Engineers' Association; Messrs. J. A. F. Aspinall (L. and Y.R.), W. Evans, Brodie Henderson, and James C. Inglis (G.W.R.); Dr. A. B. W. Kennedy; Messrs. D. A. Matheson (C.R.), E. P. Martin, E. Richards, E. Windsor Richards, A. Ross (G.N.R.), W. Howard Smith, E. B. Thornhill (L. and N.W.R.), and J. M. While.

The Sub-Committee on Railway Rails was as follows, Mr. James C. Inglis, Chairman; Messrs. F. R. Upcott, C.S.I.; G. L. Eyles, C.M.G.; J. Wilson (G.E.R.), W. B. Worthington (L. and Y.R.), J. A. F. Aspinall (L and Y.R.), W. Evans, Brodie Henderson, E. Windsor Richards, A. Ross (G.N.R.), E. B. Thornhill (L. and N.W.R.), and J. M. While.

The steel for the rails is to be of the best quality made by the Bessemer, Siemens-Martin or other process, to be approved by the engineer (or by the purchaser). The rails are to conform to the following limits:—

| | | | |
|---|---|---|---|
| Carbon | from .. | .. 0·35 to 0·5 | per cent. |
| Manganese | ,, .. | .. 0·7 to 1·0 | ,, |
| Silicon | not to exceed | .. 0·10 | ,, |
| Phosphorus | ,, ,, | .. ·07 | ,, |
| Sulphur | ,, ,, | .. ·07 | ,, |




"B.S." Section No. 20.
20 lbs. per yard

TABLE OF GENERAL DIMENSIONS OF "B.S." RAILS.

| No. of "B.S." Section. | Height of Rail. | Width of Head. | Nominal Weight of Rail. |
|---|---|---|---|
| | inches. | inches. | lbs. per yard. |
| 20 | $2\frac{3}{8}$ | $1\frac{3}{8}$ | 20 |
| 25 | $2\frac{7}{16}$ | $1\frac{1}{2}$ | 25 |
| 30 | 3 | $1\frac{5}{8}$ | 30 |
| 35 | $3\frac{1}{8}$ | $1\frac{3}{4}$ | 35 |
| 40 | $3\frac{1}{4}$ | $1\frac{7}{8}$ | 40 |
| 45 | $3\frac{3}{8}$ | $1\frac{31}{32}$ | 45 |
| 50 | $3\frac{1}{2}$ | $2\frac{1}{16}$ | 50 |
| 55 | $4\frac{1}{16}$ | $2\frac{3}{32}$ | 55 |
| 60 | $4\frac{1}{16}$ | $2\frac{1}{4}$ | 60 |
| 65 | $4\frac{7}{16}$ | $2\frac{5}{16}$ | 65 |
| 70 | $4\frac{1}{2}$ | $2\frac{3}{8}$ | 70 |
| 75 | $4\frac{13}{16}$ | $2\frac{7}{16}$ | 75 |
| 80 | 5 | $2\frac{1}{2}$ | 80 |
| 85 | $5\frac{1}{16}$ | $2\frac{9}{16}$ | 85 |
| 90 | $5\frac{1}{8}$ | $2\frac{5}{8}$ | 90 |
| 95 | $5\frac{9}{16}$ | $2\frac{11}{16}$ | 95 |
| 100 | $5\frac{5}{8}$ | $2\frac{3}{4}$ | 100 |

Falling Weight Test.

| Weight of Rails per yard. | Weight of Tup. | Centres of Bearings. | Drop. |
|---|---|---|---|
| lbs. | cwts | feet. | feet. |
| 20 | 5 | 3 | 8 |
| 25 | 5 | 3 | 9 |
| 30 | 10 | 3 | 10 |
| 35 | 10 | 3 | $12\frac{1}{2}$ |
| 40 | 10 | 3 | 15 |
| 45 | 15 | 3 | 15 |
| 50 | 15 | 3 | 15 |
| 55 | 15 | 3 | $17\frac{1}{2}$ |
| 60 | 20 | 3 | 20 |
| 65 | 20 | 3 | 20 |
| 70 | 20 | $3\frac{1}{2}$ | 20 |
| 75 | 20 | $3\frac{1}{2}$ | 20 |
| 80 | 20 | $3\frac{1}{2}$ | 22 |
| 85 | 20 | $3\frac{1}{2}$ | 24 |
| 90 | 20 | $3\frac{1}{2}$ | 26 |
| 95 | 20 | $3\frac{1}{2}$ | 28 |
| 100 | 20 | $3\frac{1}{2}$ | 30 |

Each rail is to be made from an ingot not less than 12 inches square at the smaller end and 14 inches square at the larger end, which must be cogged down into blooms, and have sufficient crop then sheared from each end to ensure soundness. A rolling margin of ½ per cent. under to ½ per cent. above the specified weight will be permitted, but the contract weight only will be paid for.

The following impact test is provided: From each cast a piece of rail shall be selected by the inspector and stamped with his mark and the number of the cast. From this a piece 5 feet long shall be cut, which shall be placed in a horizontal position, with the head uppermost, on two iron or steel supports resting on solid foundations, the upper surfaces of the supports being curved to a radius of 3 inches: this sample may be taken from a crop end. The test shall comprise one blow, delivered midway between the bearings, from a falling weight or tup, the striking face of which shall be curved to a radius of not more than 5 inches. The weight of tup, span of test piece between centres of bearings, and height of drop for the various sections of rails being as tabulated on page 644. In addition to the above test the inspector shall select one finished rail from every 200 offered, and a piece 5 feet in length cut from this rail shall be similarly tested as specified above.

Should any rail show fracture under the falling weight test, the entire cast from which it was selected shall be rejected.

The following tensile test is provided for: From each 100 tons of rails the manufacturer shall (if required by the representative of the engineer or of the purchaser) cut a test piece from any rail selected as a sample rail; such test piece to be stamped to correspond with the sample rail. It shall then be placed in a testing machine of approved pattern, and shall show an ultimate tensile strength equivalent to not less than 40 tons per square inch nor more than 48 tons per square inch, with an elongation of not less than 15 per cent. upon the standard test pieces. Should the test piece fail to fulfil these conditions, the representative of the Engineer (or of the purchaser) may require the manufacturer to test two other rails from the same cast in the same manner, and the acceptance or rejection of the cast shall be decided by the result of the three tests, so that if two of the three rails selected fail to comply with the test the entire cast will be rejected.

## THE OPENING OF NEW PREMISES IN HOLBORN BY MESSRS. MABIE, TODD AND BARD.

THE opening of the new home of the "Swan" Fountain Pen by Messrs. Mabie, Todd and Bard, was celebrated on the 16th inst., at the Holborn Restaurant by an informal, but very enjoyable lunch. The numerous guests were cordially received by Mr. Alfred Watts, the duties of the chair being undertaken with much geniality by Mr. Walter Haddon. Messrs. Mabie, Todd and Bard may be said to have brought the fountain pen to London, and the fact that they are still pioneers, and are making more gold pens than any other firm in the world, is certainly eloquent. Moreover, the history of the firm's operations over here should be an instructive object lesson for firms who are introducing a new commodity. Their advertising was at first far from pretentious, but it was persistent, and it is significant that the firm now advertise in some 400 different journals.

They commenced with a small establishment in Cheapside, and extended their premises gradually with the growth of the business. When the superiority of the "Swan" Fountain Pen became sufficiently known larger premises were opened at 93, Cheapside. In 1893 a West-end branch was opened at 95 Regent Street, and by that time the business had attained considerable importance. It was found necessary to enlarge the Cheapside establishment, and branches were opened at Manchester, Paris and Chicago, the parent house in New York being also removed to larger premises, with a corresponding increase in the factory organisation. Now the old headquarters in London have proved to be entirely inadequate, and have been transferred to handsome new premises at 79–80, High Holborn, where callers can have the additional advantage of reading and writing rooms and the telephone service.

The luncheon, for which an excellent menu was provided, was followed by speeches contributed by the chairman, his partner, Mr. Smith, Mr. Alfred Watts, whose health was given with musical honours, Mr. Robert Barr, and others. At the special request of Mr. Mabie, from New York, the signatures of all who attended were inscribed upon copies of the menu, and a pleasant surprise was the gift to each guest of a souvenir fountain pen.

# OPENINGS FOR TRADE ABROAD.

### Italy.

A Bill has been introduced by the Minister of Public Works, to provide for the expenditure of about £1,600,000 on the purchase of rolling-stock and other materials for railways. The Bill contains a clause restricting the purchase of materials to native establishments, except in the case of those which are not manufactured in the country.

### Belgium.

The Société Nationale des Chemine de Fer Vicinaux invite tenders for the construction of a railway between Ittre and Virginal, and the improvement of the main road between these districts, at the estimated cost of about £7,170, the adjudication to take place on March 29th; the construction of a section of the projected line from Poulseur to Trocz, at the estimated cost of about £3,905 the adjudication to take place on May 3rd. A deposit of £720 is required in the first case, and of £400 in the second, to qualify any tender.

Tenders in registered envelopes, addressed to "M. le Directeur Général, 14, Rue de la Science, Brussels," must be posted not later than the day previous to the date of adjudication.

### Sweden.

The Registrar of the State Railway Administration, Stockholm, is prepared to receive tenders until 31st inst. for the supply of 3,250 metres of tram-rails with fish-plates, bolts, etc., four sets of junction rails, and two electric traverses.

### British India.

The Madras Railway Company are prepared to receive, tenders until Monday, 27th inst., for the supply and delivery, free on board, of wrought iron and steel bars, sheets, plates and wire, copper and brass sheets, wire and rivets, zinc, tin, galvanised and lead sheets, pig-lead, files, wood screws, nails, chain, vices, picks, shovels, crowbars, hammers, wrenches, braces, augers, carpenter's tools, door bolts, locks, buckets, copying presses, lamp fittings, cutlery, general ironmongery, globes and gauge glasses, lenses, and fog signals, as per specifications to be seen at the Company's offices, 1, Broad Street Place, Finsbury Circus, E.C.

### French India.

The sum of 4,923,000 francs was recently voted for various public works in the French Settlements. These comprise improvement of the water supply of Pondicherry and Chandernagore; restoration of dam at Poulearcoupam; improvement of shipping accommodation at Karikal; construction of a railway from Vridhachellam to Cuddalore; erection of a hospital at Karikal, and extension of the pier at Pondicherry.

### China.

A body of influential merchants and others, of the Province of Kiangsi, have presented a petition to the Ministry of Commerce asking permission to form a provincial syndicate for the construction of a railway between Nanch'ang, the capital, and Kiukiang, the treaty port, of Kiangsi. The funds for the construction works are to be provided from the reserve and emergency funds of each district and sub-prefecture of the province, and money subscribed at will by wealthy landowners and merchants of Kiangsi.

### Cape Colony.

A Board of Trade correspondent in Cape Town states that there is a good opening for steam rollers in Cape Colony. This is consequent on the steps which are being taken by the various Divisional Councils to improve the main trunk roads in all parts of the Colony. Steam rollers are already largely used for road-making purposes in Cape Town, and now that macadamised roads are being laid down more and more, it is certain, says the writer, that the demand for these implements will increase.

### Transvaal.

Tenders are invited by the Municipal Council of Johannesburg for the undermentioned electric tramway and lighting materials, and for erection of same to Specification No. 13 of their consulting engineers, Messrs. Mordey and Dawbarn, of 82, Victoria Street, S.W. Consideration will be given to tenders for any one or more of the five following sections:—

(A) The supply of tramway poles and brackets; (B) the supply of feeder pillars, controllers, insulators, and all overhead material; (C) the supply of street arc lamps, glow lamp fittings, lanterns, ornamental lamp posts, automatic switches, etc.; (D) the erection of the material included in Sections A, B, and C; (E) the supply of a motor tower wagon.

Copies of the specifications may be seen at the consulting engineer's office, and may be obtained on payment of five guineas, returnable on receipt of a bona fide tender, which should be endorsed "Johannesburg Tender to Specification No. 13," and addressed to Messrs. Mordey and Dawbarn, in order to reach them not later than May 8th next.

# POWER GAS.

By F. H. Bowman.

THE improvements made during the last few years in internal combustion engines have given a great impetus to their use for all purposes, and specially for the generation of electricity for light and power distribution.

The utilisation of blast furnace gas is now becoming the rule rather than the exception, and in place of being burned under boilers, for the purpose of generating steam power, is being used in large gas engines after proper cooling and purification, so as to remove all dust. The use of natural gas, or gas derived from sources as above, can only, however, be made to a limited extent, as such gas is not available in the great majority of cases where large power and light distributing stations have to be put down.

This leads to a consideration of producer gas plants. Of these plants it is only necessary to mention the Wilson, Mond, Duff, Duff-Whitfield, and Dynamic Bituminous plant. It must be remembered that in all these cases it is not every kind of bituminous slack which can be used. With a good bituminous plant and recovery of residuals and a modern gas engine developing 1,000 b.h.p. on a full load, a b.h.p. can be produced at a cost of under 0·2d. per hour, including everything, and a kilowatt hour for 0·25d. per hour at the pole of the dynamo. With a pressure plant such as a Dowson, using anthracite or coke, a b.h.p. may be obtained, including everything for about 0.45d. per hour, and a kilowatt hour for 0·6d. per hour.

### DYNAMIC GAS PRODUCER.

The Dynamic gas producer is claimed to be the most perfect of its type, and when suitable fuel is employed and the engine properly constructed in regard to the proportions of its valves and the compression of the gas before ignition, it is at present the most economical source of power which can be obtained. The composition of the gas is practically the same as produced in a pressure plant using non-bituminous fuel, but it is much more regular, and the calorific value can go as high at 155 b.t.u.; but its average value is about 150 b.t.u., being a mixture of producer and water gas.

The engine and producer, however, in this suction plant being exactly suitable to each other, the engine has absolute control—not only of the quantity, but also the quality, of the gas, and the regularity in the composition much exceeds that from any pressure plant. Analysis of the gas taken from a Dynamic gas producer, even when running on an irregular load, showed no variation exceeding from 148 to 155 b.t.u., and samples taken at regular intervals during many hours showed a regular average of about 42 per cent. of combustible matter. The first suction plant put down in this country to drive a public electric lighting plant was at the Suffolk Electricity Supply Company's station at Stowmarket, where the results were most satisfactory.

### THE CAPACITY OF PRODUCERS.

These producers can be made to drive any power required, and for which gas engines can be made, and under suitable conditions more than one engine or a multi-cylinder engine can be driven from the same producer. Many are now working successfully in all parts of the country, driving every class of machinery from large textile mills where absolutely steady running is essential, down to heavy machinery in engineering works. They are also employed in public and private electric light and power stations, and the working and economy have never been exceeded.

The author has installed several plants in which two engines are running from the same producer with great success, even when there is a great disparity between the two in size. The table on page 648 is instructive.

The one disadvantage of a suction gas producer is that it cannot be worked on an absolutely light load for any length of time, because when no air or an insufficient quantity of air is drawn into the producer the temperature of the fuel falls, and so at last it is reduced to the point that good gas is not produced. This is specially the case in small plants where the volume of incandescent fuel is small. The limit of satisfactory working on light loads seems to be about one-fifth of the total load. A 50-b.h.p. engine will not work for long under 10 b.h.p. In large units where there is a greater reserve of heat the elasticity is greater, and no difficulty is experienced in taking off or putting on a large proportion of the load without any variation in the running.

In making comparison between the advantages of a power plant with suction producers and any other form, such as steam or water power, the limitations

already named must be taken into account. For single units above 2,000 b.h.p. no advantage can at present be gained over steam or water power where bituminous fuel is cheap or the water supply abundant, but the advantage is that even with units from 100 b.h.p. up to 500 b.h.p. as great economy can be obtained as with the largest steam or water plant under the most favourable conditions, and thus even small industries can obtain power under the "most favoured nations clause" for commercial competition.

### SOME COMPARATIVE FIGURES.

If a comparison is made between a gas engine using town's gas, and the same engine with suction producer gas, the results are very remarkable and differ, of course, with the cost of the town's gas and the anthracite. A plant recently put down in Yorkshire at the works of the Weldrivet Boiler and Motor Company, Ltd., Halifax, drives a 60-b.h.p. Campbell gas engine, and the power, which is on the average about 30 to 40 b.h.p., is distributed electrically. The cost per week of 54 hours with town's gas at 2s. 6d. per 1,000 cubic feet was about £3 18s. per week. Since the suction plant has been put in the cost of the anthracite coal has not exceeded 14s. per week, or rather less than one-tenth of a penny per b.h.p. Compared with using town's gas we may say roughly the saving per 1,000 cubic feet ranges from 50 to 84 per cent., according to the price charged for gas.

These figures give the saving in fuel alone. This percentage is borne out by the experience of many larger plants.

The use of such a plant as against any small steam engine and boiler of the same size, which would probably be a vertical boiler and engine combined, offers a very great advantage, since any engineer who has had experience of such a plant knows that a continuance of 12 b.h.p. could not, including everything as above, be obtained with such a plant at three times this amount.

Treating such a small plant as the generating station for the electric light it will with 12 h.b.p. supply 120 16 candle-power incandescent lamps, and to get the cost per unit of electricity, there must be added the interest at 10 per cent. on the cost of a suitable dynamo, which, with strap to drive, fixing and accessories, may be taken to cost £80. The interest at 10 per cent. will be £8 per annum, and we have, therefore, to add to the figure 0·51d. per b.h.p.

$$\frac{8 \times 20 \times 12}{3{,}000 \times 12} = \frac{1{,}920}{36{,}000} = 0{\cdot}053 \text{ pence},$$

which brings the cost up to 0·563d. Adding one-quarter to this we get the cost per b.t.u. per hour = 0·704d. per hour, which is a little less than ¾d. per b.t.u.

The continuous improvements which are being made in gas engines, however, seem to indicate that before long, still larger units may be advantageously employed, and while the efficiency of the gas engine is considerably higher than that of the steam engine at present, the possibilities of future improvement are much greater.

Figures show that the gas engine is at present, even compared with the very best steam engines, 5·4 per cent. more efficient, and if both were made absolutely

## Test of Dynamic Gas Producer for Coal Consumption.

Made by J. WHITWORTH, Engineer.

| Name, Size, and Speed of Engine, and Description of Brake. | Condition of Producer before and after test | Starting up Producer. TIME. | COAL CONSUMPTION. Best Welsh Anthracite Nuts used. |
|---|---|---|---|
| Crossley Brothers' "Otto"<br>8½ inch Cylinder.<br>15 " Stroke.<br>250 revolutions per minute.<br>Brake, 44 in. diameter to centre of rope.<br>Weight of Cast-Iron Pan .. 101¾ lbs.<br>Weight in Pan .. 42<br>143¾<br>Spring Balance showed .. 8<br>$(W - w)$ = 135¾<br>Explosions counted every 30 minutes.<br>Varied from 106 to 110 out of poss. 125.<br>Brake Horse Power .. .. 11·5<br>Indicated " .. .. 12·5 | Producer working the day before shut down at 5 p.m<br>Producer half full of fuel<br>Ashpit cleaned out before starting test<br>**AFTER TEST**<br>After test contents of Ashpit were riddled out through a ¼-inch mesh riddle.<br>Unconsumed large coal 13lbs.<br>" small coal 10lbs.<br>Ash, 4 % .. .. 3 lbs<br>Fuel in Producer left at same level as before the test | Started to blow up Producer with hand fan .. 11-0 a.m<br>Got Gas .. .. 11-5 "<br>Engine Started .. 11-6 "<br>Fan Stopped .. 11-6 "<br>Load on Brake .. 11-7 "<br>Engine up to speed 11-11 "<br>Put in first charge of fuel .. 11-11 "<br>Put in last charge .. 3-35 p.m.<br>Engine shut down .. 4-10 "<br>Total Time of Test . 5 hours | Total Coal put into Producer 74 lbs.<br>Ash, 4 % .. .. 3 lbs.<br>71 lbs<br>Unconsu. large coal 13<br>" small coal 10<br>23<br>Total Coal used .. 48 lbs.<br>$\frac{48}{5}$ = 9·6 lbs. coal per hour.<br>$\frac{9{\cdot}6}{11{\cdot}6}$ = 0·835 lbs. per B.H.P.<br>$\frac{9{\cdot}6}{12{\cdot}5}$ = 0·768 lbs. per I.H.P.<br>**COST OF RUNNING.**<br>Coal 32/- per ton.<br>7th of a penny per B.H.P. hour.<br>8th " " I.H.P. "<br>THIS IS FOR FUEL ONLY. |

REMARKS.—The Producer worked perfectly constant as seen by the Engine's constant speed and very regular explosions. There is no smell or dirt. Requires very little attention—one man for Producer and Engine. Speed was counted and diagrams taken every thirty minutes

perfect the gas engine would be 46 per cent. more efficient than the steam engine.

On the Continent very large suction plants have recently been put down for light and power purposes.*

## ELECTRIC LIFTING MACHINERY.

At the last meeting of the Birmingham and District Electric Club, Mr. Edward C. R. Marks read a paper with the above title, of which the following is an abstract :—

The most suitable form of electric energy is continuous current at 220 to 500 volts. This is superior to alternating current on account of the greater starting torque and acceleration given by the former. The operations of a crane involve a rapid succession of startings and stoppings; continuous running occupies an unimportant fraction of the time, and loads are very variable. Alternating current motors while efficient at full loads, can have a strong starting torque only at the expense of efficiency. Continuous current on the other hand admits of easier regulation of motors, is cheaper than wiring, and can be stored in batteries to equalise a variable load. Series-wound motors, which automatically run faster with lighter loads, should be used if they are coupled permanently to the gearing. They should withstand 100 per cent. overloading for short periods, and much higher loads momentarily without damage; which conditions are fulfilled by the ordinary tramway type.

Where motors run continuously, with clutch connections to the gearing, they should be shunt-wound. The proper speeds for a crane depend on the purpose for which it is intended. The ideal condition is rapid acceleration, uniform motion at high speed, and quick slowing down. Rapid acceleration can be obtained by employing series-wound motors, if permanently conpled or by the inertia of a continuously-running motor, if working through clutches.

On the question of voltage for electric overhead travelling cranes, a well-known American firm of large experience thus express themselves: 240 to 250 volts at the generator, with not less than 220 volts at the motors, has become practically the standard for crane service. The expense of conductors of suitable size to economically carry the necessary current is not excessive, and the tendency to establish grounds and short circuits at the various connections and insulation, because of excessive dust and moisture, is very much less than where higher voltage is used. The use of 110 volts for cranes of small size is not seriously objectionable, but the use of 500 or 600 volts, especially in foundries and steel plants where dust, moisture, and metallic oxides soon cover many parts of the crane, calls for constant self-regulation of speed.

### BRAKES.

The brake equipment of a crane presents greater difficulties than the lifting equipment. If the brake does not properly take care of or control the load after the lifting effort ceases, disaster follows. As an American writer has well put it: "There is no trouble in getting the load to go up, as this is only a matter of gearing and power. The real test of fitness comes when the load has to go down, and go with some show of regard for the proper landing place." In a well-designed crane, fully 75 per cent. of the work represented by the load descending under brake control, is converted into heat. Such heat generated at the brake must be thrown off fast enough to prevent an excessive rise in temperature, such as would damage the friction surfaces, or, what is far worse, set up internal stresses likely to produce fracture. A sudden fracture in a rapidly revolving brake-wheel may result in consequences akin to those of a boiler explosion.

* Abstract of paper read before Leeds Local Section, Institution of Electrical Engineers.

## INSTITUTION OF MECHANICAL ENGINEERS.

A special meeting has been called for to-night, when Professor Capper's paper, "First Report to the Steam Engine Research Committee," read at last Friday's meeting, will be further discussed.

The Council draw the attention of all classes of members to By-law No. 7, which reads as follows: "The abbreviated distinctive titles for indicating the connection with the Institution of Members, Associate Members, Graduates, Associates, or Honorary Life Members thereof, shall be the following :—for Members, M.I.Mech, E.; for Associate Members, A.M.I.Mech.E.; for Graduates, G.I.Mech.E.; for Associates, A.I.Mech,E; for Honorary Life Members, Hon.M.I.Mech.E," Other abbreviations are not recognised as appertaining to this Institution.

At the Ordinary Meeting of the Institution of Civil Engineers on 7th March, Sir Guilford L. Molesworth, K.C.I.E., President in the Chair, it was announced that twelve associate members had been transferred to the class of Members, viz., Messrs. C. Brownridge, H. Deans, B.A. (Cantab.); W. Emmott, A. Fidler, A. P. Griffiths, B.Sc. (Paris); H. Japp, I. P. Marshall, H. F. Peet, E. van Putten, J. R. Settle, R. C. Sikes, B.E., B. A. (Royal), F. Wood.

# INSTITUTION OF MINING AND METALLURGY.

THE annual general meeting was held last week at Burlington House, Piccadilly, W., when the newly elected President, Mr. Wm. Frecheville, delivered his address.

The President, in his opening remarks, dealt with new sources of mineral wealth within the British Empire. He referred to the possibilities of important finds in the Himalayan country and in Australia, pointing out that the fact that the fringe of known and occupied country surrounding Australia, from Queensland, through New South Wales, Victoria, and South Australia, to West Australia, was not only mineral-bearing, but richly so, indicated that the probabilities of further discoveries being made towards the interior were very great.

Addressing himself to new developments in mining appliances the President referred to the working of deep alluvial ground for gold by means of so-called pump dredges. Improvements had been made in this direction, and several large plants were now working successfully. One he saw recently was on Adelong Creek, in New South Wales, where the gravels filling the valley of the creek are about 40 ft. deep, and the hard and uneven nature of the bed rock (granite) was such that bucket dredges, which work considerably cheaper than pump dredges, would leave a large portion of the gold behind. The plant appeared to be working about an acre per month to a depth of 40ft., at a cost of about 4½d. per cubic yard. The conditions which had made the plant a success, in comparison with early failures of similar plant in the same locality, were large power and large, specially designed, centrifugal pumps with removable linings.

### COMPOUND CENTRIFUGAL PUMPS.

Another new development was the use of compound centrifugal pumps for high lifts. A large plant of that kind, for pumping about 1,000 gallons per minute from a depth of 1,450 feet, was put in a few years ago by a French company owning the important silver-lead mines at Horcajo, Province of Ciudad Real, Spain. The total height of 1,450 feet was accomplished in four lifts, each lift being done by a quadruple centrifugal pump, driven by a three-phase motor. These quadruple pumps consisted of four pump-discs on the same shaft and in the same housing or case, each disc being calculated to lift about 125 feet, and delivering its water to the next, which in its turn imparted an additional and equal impulse or push. By this system it was found possible to raise water to heights which a few years ago would have been considered impossible for centrifugal pumps.

It was stated that water was being raised somewhere about 1,200 feet in one lift, by these means, in a colliery in Germany.

The ball-bearing thrust-blocks of the pump appeared to be the principal cause of anxiety, but in the more recently constructed pumps a better balance had been effected. As regarded efficiency, the makers guaranteed that 68 per cent. of the power given out by the motor when running at its proper speed should appear in water pumped.

According to the data supplied at Horcajo the coal consumed per water horse-power hour amounted to about 2·2 kilos, say, 4·8 lb., equivalent, with the quality of coal used, to about 34 lb. of steam, and the whole plant, at surface and underground, was said to have an overall efficiency of about 50 per cent., as measured by the water pumped. In a recent tender for such plant a well-known firm, using Parsons' turbines in the generating station, offered to guarantee a coal consumption of 3·66 lb. per water horse-power hour, and stated that if gas engines were used, the coal consumption would be about 2·7 lb. for the same work.

### A COMPARISON WITH CORNISH PUMPS.

In order to compare these figures with the results which were being obtained by large Cornish pumping plants, it should be mentioned that the ordinary Cornish engine was stated by authorities on the subject to use from 3½ to 3¾ lb. of good coal per water horse-power hour. Somewhat higher efficiency than this had at times been claimed, and the more recent compound engines, using high pressure steam, were stated to be only using from 2½ to 3 lb. of coal. A weak point in connection with these high-lift centrifugal pumps was that they had not yet been used successfully for sinking. The trouble appeared to be that they lost the water when going "in fork." Efforts were being made to overcome that difficulty.

Another feature which might be somewhat of a drawback, under certain circumstances, was that,

like all centrifugal pumps, to get a good efficiency, they must be driven at a certain speed, and if this speed was departed from the efficiency fell off very rapidly.

Regarding the information usually given to shareholders in a mining company, it had come to be recognised by mining companies that they were expected to give shareholders periodically a correct statement of the ore "in sight," but, as regarded the appearance of the bottom of the mine and the future prospects, there was often room for very much more candour. Too frequently the first intimation a shareholder got that something was wrong with his mine, was given by the falling market value of the shares. It might be stated broadly that a manager of a mine in his periodical letters, gave free expression to his hopes and fears, and that any important change for better or for worse was, as a rule, foreshadowed a long time before it happened.

Shareholders ought to have that information, which was obtained at their expense, and would be of much use in aiding them to form a just estimate of the value of their property.

Reviewing the objects and aims of the Institution and what had been achieved, Mr. Frecheville said that one important advance in the educational question, which had been made during the year, was the establishment of post-graduate scholarships at the Royal School of Mines, entitling the holders to go through a practical training at mines. It was to be sincerely hoped that the practical training would be worked on such lines as to prove a great success.

## INSTITUTION OF ELECTRICAL ENGINEERS.

The members of the Manchester section of the Institution of Electrical Engineers held their annual dinner at the Midland Hotel. Mr. C. D. Taite, president of the section, was in the chair and among the guests were the Mayor of Salford (Mr. Alderman Stephens), Mr. S. L. Pearce, Mr. W. M. Mordey, Mr. H. A. Earle, Dr. Edward Hopkinson, Mr. F. E. Priest, Mr. A. Saxon (president of the Manchester Association of Engineers), Mr. J. S. Raworth, and Mr. T. L. Miller. The principal toast, "The Institution of Electrical Engineers," was proposed by Mr. H. A. Earle, and acknowledged by Mr. W. M. Mordey, who spoke of the rapid growth of the organisation (which was originally an offshoot of the Association of Engineers), and mentioned that there are now 5,700 members). Connected with the Institution are also six local sections (the greatest of which is Manchester), as well as sections at Capetown and Calcutta.

## DEVELOPMENT OF THE TORPEDO-BOAT DESTROYER.

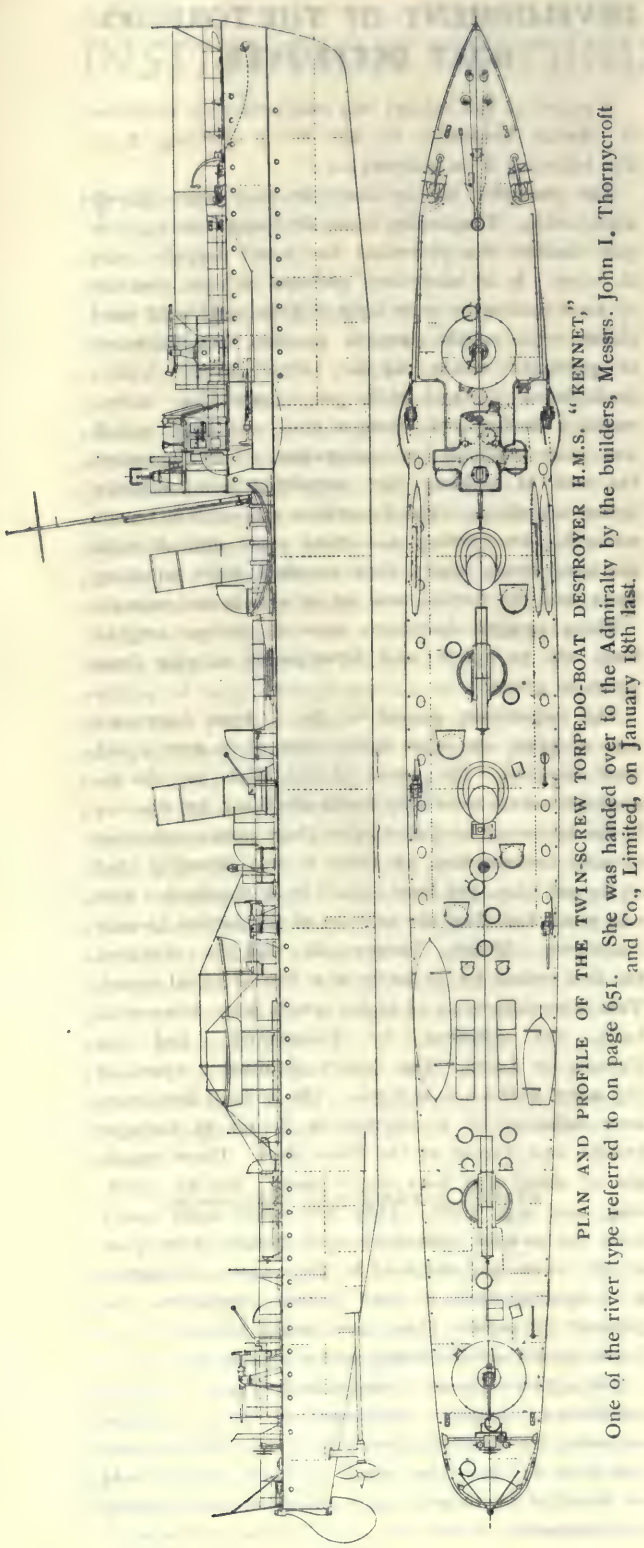
A paper on this subject was read before the Institute of Marine Engineers by Mr. W. J. Harding, R.N. The following is an abstract:—

The precursor of the destroyer class was evolved about 1884. Practically these destroyers were given just double the power of the latest torpedo-boats in being. It is interesting perhaps to note, that the 27 knot destroyers were built of galvanised mild steel plates, with tensile strength 30 tons, the thickness of garboard strake 6½ lb.; sheer strake, 9 lb.; deck-plating, 6½ and 8½ lb. per square foot. Afterwards a harder and stronger steel was used, which was more difficult to manipulate. This increased the cost of building but permitted comparatively lighter scantlings, This latter steel was 40 tons tensile strength. Its riveting was much more difficult with the hard rivets used; they required more knocking down, and the riveting was not so comely and smooth.

These 27-knot destroyers were of various lengths from 180 to 190 ft. and horse-power varying from 3,700 to 4,800.

The experience gained in the 27-knot destroyers was of great use when faster ones of 30-knot speed were required. The terms of the trials for the 30-knot destroyers were very much amplified, for whereas in the former 27-knot destroyers there were no reserves of coal consumption, in these it was intended that 2½ lb. per i.h.p. per hour should be a standard. This was much less than the average of the former 27-knot destroyers. Messrs. Thornycroft and Co. obtained the first record for 30 knots in a British naval vessel. Two other destroyers of higher speeds were afterwards built, the *Albatross* by Thornycroft, and the *Express* by Laird. The former obtained a speed of 31½ knots with i.h.p. of 7,700. The 30-knot destroyers were followed by a reaction in favour of stronger vessels, now known as the *River* class. These vessels are of about 550 tons displacement, 200 to 230 ft. long, and h.p. 7,500. They are much more costly than the 30-knot destroyers, and though their speed of 25½ knots was obtained in deep water, the author is of opinion that, if the 30-knot destroyers had different propellers fitted they would outrace all the *Rivers* at war-service lading with a smaller coal bill.

The author suggests a coast volunteer corps could be established, largely composed of young marine engineers, for service in these vessels as coast defenders, and that in war, the whole of our coasts could be defended by torpedo-boats and destroyers, leaving the battleships to do their work for the high seas.



PLAN AND PROFILE OF THE TWIN-SCREW TORPEDO-BOAT DESTROYER H.M.S. "KENNET,"

One of the river type referred to on page 651. She was handed over to the Admiralty by the builders, Messrs. John I. Thornycroft and Co., Limited, on January 18th last.

## CAGE SKELETON CONSTRUCTION.

A large party of members of the Junior Institution of Engineers recently visited the new Ritz Hotel, Piccadilly, to inspect the "Cage Skeleton System of Constructional Engineering" at the invitation of Mr. J. P. Bishop, one of the joint architects.

The new Ritz Hotel affords the largest example of the type in this country. A skeleton of steel framework, capable of carrying the whole deadweight of the walls, floors and roof, in addition to the live loads and wind pressure, is being erected, and is at present nearly completed. The walls are supported on girders at the level of each floor of the building. They carry no loads, but simply serve as a protection from the weather and for decorative treatment. The total weight of the building, with the live loads, is carried on the steel columns. Generally, the columns rest upon cast-iron base plates, about three to four feet square, which in turn rest upon a grillage of steel beams imbedded in cement concrete of sufficient area to distribute the load over the ground with a minimum depth of foundation. Cantilever foundations have been adopted for some of the columns next the adjoining buildings, so as to retain the whole of the foundations within the site. Some of these foundations may be seen in the basement. The building is of fireproof construction throughout. The whole of the steel work will be encased in masonry or concrete. The floors and roofs are of concrete steel on the Columbian system. The floors are hollow so as to be sound proof, and the construction adopted permits of a flat ceiling throughout, without panels, so as to give apparent greater height to the rooms.

## ELECTRICAL EXHIBITION.

An exhibition of electrical apparatus, under the style of the Holborn and Finsbury Electrical Exhibition, is now open. It has been organised by the County of London Electric Supply Company, which has areas of supply in Finsbury, Holborn, Wandsworth, Camberwell, Southwark, and Bermondsey, with the desire to popularise the use of electricity and to afford consumers an opportunity of inspecting the latest developments in connection with electrical lighting and heating and the application of electricity for driving machinery. Over sixty firms have contributed exhibits.

# Engineering at Oxford University.

AN important announcement has been made in connection with the University of Oxford, whereby diplomas in scientific, engineering and mining subjects will be granted under statute passed last year. The object of the diploma courses is to provide those members of the University who intend to become mining or other engineers, with a sound preliminary training which will enable them to be thoroughly prepared for the study of the more technical branches of their subjects elsewhere than Oxford. To meet the case of those who intend to become colliery engineers, arrangements have been made with the Home Office by which a special form of the diploma will be accepted in lieu of two of the five years' underground work required as a qualification for obtaining a certificate as colliery manager. A candidate for the diploma must be a member of the University, must have passed all the examinations required for the degree of B.A., must have followed a course of study approved by the Committee in scientific engineering and mining subjects during two years, is bound to pass certain examinations, and must have undergone a course of practical training approved by the committee during four months in a mine or in engineering works.

The courses of the several diploma-subjects will be under the general supervision of the following : (*a*) Mathematics for applied science, Professor A. E. H. Love, M.A., D.Sc., F.R.S. ; (*d*) Engineering, principles and machine drawing, Rev. F. J. Jervis-Smith, M.A., F.R.S. ; (*e*) Surveying, H. N. Dickson, M.A., D.Sc. ; (*f*) Geology, Professor W. J. Sollas, M.A., Sc.D., F.R.S. ; (*g*) Mineralogy, Professor H. A. Miers, M.A., D.Sc., F.R.S. ; (*h*) Mining and Engineering hygiene and mine-ventilation, J. S. Haldane, M.A., M.D., F.R.S. ; (*i*) Electricity, Professor J. S. E. Townsend, M.A., F.R.S., Wykeham Professor in Physics ; (*j*) Assaying, H. B. Baker, M.A., D.Sc., F.R.S. In the subjects (*b*) Physics and Chemistry and (*c*) French and German Translation, responsibility for instruction is not undertaken by the committee.

The range of knowledge required in engineering principles and machine drawing is grouped under the following heads : Strength of materials ; elements of hydraulics ; thermodynamics, and machine design, including the design of electric motors and generators of electricity, and engineering drawing. In electricity the subjects are electro-magnetic induction, alternating currents, with applications to the action of dynamos and motors, ammeters, and voltmeters. The mining and engineering hygiene and mine ventilation group includes analysis of air, the measurement of air currents, compressed air, poisonous gases, dust, etc. In physics and chemistry the syllabus is that of the preliminary examinations in these subjects in the Honour School of Natural Science. In framing the regulations the Committee considered a knowledge of mathematics of a practical kind and of the elements of physics and chemistry an essential preliminary to the study of more technical engineering, and they have made these subjects, as well as such a knowledge of French and German as will be necessary to read technical books in those languages compulsory for all candidates seeking the diploma.

This is a noteworthy departure in the direction of making the University courses of a more practical character, and the experiment will be watched with very great interest. The inception of this engineering course owes a good deal to Professor H. A. Miers, and he is to be congratulated on the results of his labours in this connection. Examinations in the subjects for the diploma, except physics and chemistry, will be held annually at dates to be announced. Any further information may be obtained on application to the Secretary, Mr. H. L. Bowman, at the University Museum, Oxford.

# CONTRACTORS' NEWS.

**We shall be pleased to insert under this column, free of charge, particulars of open contracts.**

## CONTRACTS OPEN.

Last Day.

**Grindleford and Rowsley.**—Construction of the Grindleford to Rowsley section of the Derwent aqueduct, in the county of Derby, for the Derwent Valley Water Board. Mr. Edward Sandeman, Engineer, Bamford, Sheffield ... ... ... ... March 27

**Hornsey.**—Supply of cables, junction boxes, fuse boxes and meters. Mr. Norman Staniland, Electricity Works, Tottenham Lane, London, N. ... ... March 27

**Marylebone.**—Carrying out of certain installation work and alterations to existing consumers' installations in the Marylebone district for the Borough Council. Specification, etc., from the electricity offices, 11, Manchester Street, London, W. March 27

**Keighley.**—One Lancashire boiler, and one 300-k.w. direct-current steam dynamo, high-speed enclosed engine, for the Electricity Commlttee. Particulars from Mr. J. M. Smith, borough electricul engineer, Electricity Works, Keighley. Deposit, £1 1s. ... ... ... ... March 27

**Great Yarmouth.**—Supply and delivery of (Section 3) surface condenser, with steam-driven air and circulating pumps, for the Corporation. Messrs. Preece and Cardew, 8, Queen Anne's-gate, Westminster, S.W. March 29

**Bolton.**—Supply and erection of cooling tower and condensing apparatus in connection with power station, for the Electricity Committee. Mr. Arthur A. Day, borough electrical engineer, Spa Road, Bolton ... ... ... ... ... March 30

**Manchester.**—Supply and erection of a Livesey washer and a rotary washer scrubber, for the Gas Committee. Specification from Mr. C. Nickson, superintendent, Gas Department, Town Hall ... March 30

**Bradford.**—Supply, erection and setting to work of 2,500 kw. of motor generators, or rotary transformers for transforming, together with the necessary controlling gear. Electricity offices, Whitaker-buildings, Bradford. ... March 30

**Shanghai.**—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the streets of the Settlement of Shanghai; alternative proposals are desired for the single-trolley and double-trolley lines. Council's agents, Messrs. John Pook and Co., 63, Leadenhall Street, London, E.C., and Messrs. Fearon Daniel and Co., 90, Wall Street, New York. ... March 31

Last Day.

**Newport (Mon.).**—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport (Mon.) .. April 1

**Rishworth (Yorks.)**—Construction of a concrete service tank (56,000 gallons), on Rishworth Moor, including wood and slate roof, for the Rishworth Urban District Council Waterworks. Messrs. Richard Horsfall and Son, surveyors and architects, 22a, Commercial Street, Halifax April 1

**Aberdeen.**—Erection of new bridge of steel girders and masonry, for the Alford and Huntley District Committee. Mr. James Barron, Central Chambers, 216, Union-street, Aberdeen. ... ... April 3

**Birmingham.**—Supply, delivery, and erection of 200 electric tramway cars for the Tramways Committee. Mr. Alfred Baker, general manager, 254A, Corporation Street, Birmingham ... ... ... ... ... April 4

**Glasgow.**—Electric power generating and lighting plant for Clydebank Dock, for the Trustees of the Clyde Navigation. Mr. T. R. Mackenzie, general manager and secretary, 16, Robertson Street, Glasgow, or from Mr. Geo. H. Baxter, mechanical engineer ... ... ... ... ... April 10

## COMING CONTRACTS.

**Chiswick.**—The District Council have decided to apply for sanction to a loan of £18,000 for sewage works.

**Maidstone.**—An inquiry has been held into the application of the Town Council for sanction to borrow a sum of £6,000 for the electrical undertaking.

**Marylebone.**—An estimate of expenditure amounting to £10,395 has been prepared for the supply of electricity distributor cables and connections.

**Paignton.**—An inquiry has been held into an application by the Urban District Council for sanction to a further loan of £41,000 to complete the Holne Moor waterworks scheme.

**Luton.**—Application is being made for sanction to a loan of £5,000 for electric lighting purposes.

**Tarporley.**—An inquiry has been held at Tarporley into an application for an order to authorise the construction of a light railway from Tarporley to the Cheshire Lines at Moulderswortb. The total length of the line will be over seven miles and the estimated cost £46,000.

**Shrewsbury.** — The Council have sanctioned an expenditure of £5,295 to carry out extensions at the electrical works.

**Newport.** — The Electricity and Tramways Committee has resolved to obtain sanction from the Local Government Board to borrow a sum to cover the cost, about £25,000, of extending the condensing plant at the electricity works, and a further sum for mains, extensions, etc.

**Ossett.**—The Town Council on Monday decided to have plans and estimates prepared for the erection of an electric light and power station in connection with the refuse destructor.

## CONTRACTS CLOSED.

**Sheerness.**—Johnson and Phillips have been awarded a contract for two direct-current dynamos for the Sheerness Dockyard.

**Durham.**—The Brush Electrical Engineering Company, Ltd., has secured an order for eight 500 k.w. three-phase transformers, for the County of Durham Electric Power Distribution Company.

**Tredegar.**—Iron and steel manufactured by Whitehead and Co., of the Deighton Ironworks, Tredegar, have been accepted by the Admiralty and by the Crown Agents for the Colonies. This is the first time for several years that Tredegar iron and steel, at one time world-renowned, find a place on the Government list.

**King's Lynn.**—The Town Council has accepted the tender of the General Electric Company, Ltd., for a steam dynamo, condenser and pipes, for the electricity station, at £1,098.

**London United Tramways.**—J. G. White and Co., Ltd., have just booked an important contract with the London United Tramways to the tune of about £165,000. The work comprises two distinct sections. The first is in Kingston, Surbiton, Malden and Wimbledon districts. The total route length of this line is about 10¼ miles, and the length of single track is about 18⅜ miles. The second section is in Hanwell and Brentford, the route length of these lines being about 2⅝ miles, and the length of single track 5⅛ miles. W. T. Henley's Telegraph Works Co. has secured the contract for cable work in connection with the above tramways extension. This includes about 30 miles of three-phase 11,000 volt e.h.t. cable, and about 45 miles of l.t. feeder, distributor and telephone cables, etc.

**Burslem.**—The Town Council have accepted the tenders of Grant and Son, for erection of electric lighting station, destructor buildings, etc., at £3,745.

**Birmingham.**—Messrs. the New Conveyor Company, Ltd., Birmingham, have secured a contract for supplying the Birmingham Corporation with coal and ash conveying plants.

**West Ham.**—We are informed that Mountain and Gibson, Elton Fold Works, Bury, have received an order through Messrs. the Brush Electrical Engineering Company, Ltd., for thirty-five of their improved M.G. double-deck trolley standards, with poles and heads complete, for the West Ham Corporation Tramways.

**Manchester.**—Bruce, Peebles, and Co., Ltd., have secured an order from the Manchester Corporation for three 500-kilowatt Peebles motor converters. They have also secured a contract from the Lancashire Electric Power Company to supply alternating current motors of 15 horse-power and above for one year, for their hire, purchase, and development department.

## APPOINTMENTS VACANT.

| | Last Day. |
|---|---|
| **Leeds.**—A lecturer in civil and mechanical engineering is required at the University of Leeds, salary, £300 per annum; a lecturer in civil engineering is also required, £300 per annum, with liberty to take up outside consulting work... ... | March 25 |
| **London County Council.**—Two divisional inspectors (at £600 per annum, rising by annual increments of £25 to £800), one possessing special qualifications in mathematics and science and the second in technology, including electrical and mechanical engineering; also an inspector in wood and metal work at £400, rising to £500... ... ... ... | April 1 |

## APPOINTMENTS FILLED.

**Larne.**—Mr. William M'Conchie has been appointed manager to the Larne and Stranraer Steamship Committee (owned by Midland, London and North-Western, Caledonian, and Great Southern and Western Railway Companies).

**Midland Railway.** — We understand that Mr W. B. Worthington, for the last eight years chief engineer of the Lancashire and Yorkshire Railway, has accepted the post of engineer-in-chief of the Midland Railway, rendered vacant by the lamented death of Mr. J. Allen McDonald.

**Battersea.**—Mr. W. A. Kemm has been appointed chief electrical engineer to the Battersea Borough Council. Mr. Kemm was formerly at St. Pancras, and later at Canterbury.

**Swindon.**—Mr. Medcalf has been appointed traffic manager of the Swindon Corporation's electric tramways at a salary of £150 per annum.

**Southend.**—Mr. J. Mitton, late mains superintendent at Southend-on-Sea, has been appointed chief assistant electrical engineer at that place.

**Glasgow.**—Mr. R. B. Mitchell has been appointed superintendent of mains to the Glasgow Corporation Electricity department, at £250 per annum.

**Perth.**—Mr. John Lambert, burgh electrical engineer at Perth, has been appointed also manager of the tramways, and his salary is to be increased from £275 to £350 per annum.

**Carlisle.**—Mr. William Dundas (of Callender's Cable and Construction Co.) has been appointed mains superintendent at Carlisle Corporation electricity works.

# Share List of Engineering, Electrical, Iron and Steel, and other Companies.

**The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.**

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—

Consols: April 5th. General Settlements: March 30th, April 13th, 28th. Bank Rate, March 9th, 1905, 2½ per cent.

## 1.—ENGINEERING, IRON, AND STEEL COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 11,370 | 5 | 5% | Alldays & Onions Pneumatic Engineering, Ltd. | 3 | 2⅞ — 3⅛ |
| 10,000 | 5 | 3/- | Do. Cum. Pref. 6 per cent. | 5 | 4½ — 5 |
| 3,210,000 | 1 | 2/6 | Armstrong (Sir W. G.), Whitworth and Co., Ltd. | 1 | 3 5/16 — 3 7/16 |
| 76,970 | 5 | 2/- | Do. 4% Cum. Pref. | 5 | 5⅜ — 5⅝ |
| 1,500,000 | 100 | 4% | Do. 4% 1st Mort. Dbs. Rd. | 100 | 104 —106 |
| £100,000 | 100 | 4½% | Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red. | 100 | 96 — 99 |
| 530,000 | 1 | 1/7½ | Babcock and Wilcox, Ltd., Ord. | 1 | 4⅜ — 4½ |
| 100,000 | 1 | 7½d. | Do. ,, 6% Cum. Pref. | 1 | 1⅜ — 1⅝ |
| 20,060 | 5 | 3/- | Baker (Joseph) and Sons, Ltd., 6% Cum. Pref. | 5 | 5 — 5½ |
| 250,000 | 1 | 6¾d. | Baldwins, Ltd., 5½% Cum. Pref. | 1 | 1 — 1⅛ |
| £250,000 | Stk | 4½% | Do. 1st Mt. 4½% Deb. Stk. Red. | 100 | 101 —103 |
| 150,000 | 4½ | 2/8⅝ | Barrow Hæmatite Steel Co., Ld., O. | 4½ | 1⅜ — 1⅝ |
| 50,000 | 4½ | 6/- | Do. do. Cum 2nd. Pref. | 4½ | 4⅜ — 4⅝ |
| 33,334 | 5 | 2/6 | Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares | 5 | 4⅜ — 5½ |
| £500,000 | 100 | — | Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd | — | 103 —105 |
| 50,000 | 10 | 6/- | Bell Brothers, Ltd., 6% Cum. Pref. | 10 | 11⅜ — 12½ |
| £366,600 | Stk | 4% | Do 4% Deb. Stock, Red. | 100 | 99 —101 |
| 200,000 | 1 | 1/- | Beyer, Peacock and Co., Ltd., Ord. | 1 | ⅜ — 1 1/16 |
| 300,000 | 1 | 6¾d. | Do. 5½% Cum Pref. | 1 | 27/32 — 29/32 |
| £300,000 | Stk | 4½% | Do. 4½% Red. Deb. Stock | 100 | 96 — 99 |
| 1,629,760 | 1 | 6d. | Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760 | 1 | 1 —1 1/32 |
| 1,860,900 | 1 | 3⅜d. | Do. Nos. 1,639,101-3,500,000 | 12/- | 1/32 — 3/32 |
| 1,160,000 | 1 | 4¼d. | Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000 | 15/- | 1⅛ — 1⅛ |
| 590,000 | 1 | 6d. | Do. Ord., Nos. 1,160,001-1,750,000 | 1 | 1 25/32 — 1 27/32 |
| 74,000 | 10 | 5/- | Do. 5% Cum. Pref. | 10 | 11¼ — 11½ |
| 154,500 | 5 | 2/6 | Cammell, Laird & Co., Ltd., Ord. | 5 | 8⅛ — 8⅜ |
| 232,500 | 5 | 2/6 | Do. 5% Cum. Pref. | 5 | 5 5/16 — 5 7/16 |
| 450,000 | 1 | 1/6 | Clayton & Shuttleworth, Ltd., Ord. | 1 | 1 — 1 1/16 |
| 70,000 | 5 | 2/6 | Do. 5% Cum. Pref. | 5 | 5⅛ — 5⅜ |
| £250,000 | Stk | 4% | Do 4% 1st Mort. Db. Stk. Red | 100 | 100 —102 |
| 100,000 | 10 | 7/6 | Consett Iron Co., Ltd., Ord. | 7½ | 32— 33 |
| 57 031 | 10 | 10/- | Crossley, Bros., Ld, Ord. 40340/97370 | 10 | 16 —16½ |
| 40,339 | 10 | 5% | Do. 5% Cum. Pref. | 10 | 11⅜—11¼ |
| 75,000 | 1 | 2/6 | Delta Metal, Ltd. Shares | 1 | 2 — 2¼* |
| 1,259,594 | 1 | 3⅜d. | Dorman, Long & Co., Ltd. | 1 | ⅜ — 1/2 |
| £400,000 | Stk | 4% | Do. 4% 1st Mort. Perp. Deb. Stk. | 100 | 91 — 94 |
| 200,000 | 5 | 3/- | Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating | 5 | 3⅜ — 3⅝ |
| 250,000 | 1 | 9⅜d. | Dunlop (James) & Co., Ltd., Ord. | 1 | 1/16 — 1/16 |
| 300,000 | 1 | 7½d | Do. 6% Cum. Pref. | 1 | 15/16 — 1 |
| 4,721 | 13 | 12/- | Ebbw Vale Steel, Iron & Coal Co., Ltd. | 13 | 9 — 10 |
| 69,754 | 13 | 12/- | Do. do. do. | 10 | 7¼— 7⅜ |
| 20,250 | 10 | 8/- | Elliott's Metal, Ltd. | 8 | 4⅜ — 5¼ |
| 5,000 | 10 | 5% | Do. Cum. Pref. 5% | 10 | 8⅜ — 9¼ |
| 186,748 | Stk | 4% | Do. Deb. 4% | 100 | 94½ — 96½ |
| 25,000 | 10 | 6/- | Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. | 10 | 10⅜ — 11¼ |
| £250,000 | Stk | 4½% | Do. 4½% Mort. Deb. Stk. Red. | 100 | 100 —103 |
| 9,000 | 10 | 10% | Fleming & Ferguson, Ltd. Ord. Nos. 1/9000 | 10 | 12½—12¾ |
| 6,000 | 10 | 5% | Do. 5% Cum Pref. Nos. 9001/15000 | 10 | 9½—10 |
| 126,000 | 3 | 3/- | Fraser & Chalmers, Ltd., Ord. | 3 | 4⅜ — 4⅞ |
| 21,000 | 3 | 1/6 | Do. 7½% Cum. Pref. | 3 | 5¾ — 6¼ |
| 10,000 | 10 | 5% | Galloways, Ltd., 5% Cum. Pref. 18001/28000 | 10 | 6 — 7 |
| £150,000 | Stk | 4% | Do. 4% 1st Mort. Deb Red. | 100 | 90⅛—91½ |
| 16,800 | 10 | — | Greenwood & Batley, Ltd., Ord. | 10 | 4¼— 4½ |
| 9,600 | 10 | 7% | Do. 7% Cum. Pref | 10 | 10¼— 10⅜ |
| 965,000 | 1 | 1/- | Guest, Keen & Nettlefolds, Ltd. Ord. | 1 | 2⅜ — 2½ |
| 344,000 | 5 | 2/6 | Do. 5% Cum. Pref. | 5 | 6 — 6 1/16* |
| £1,850,500 | Stk | 4% | Do. 4% Irred. Mort. Deb. Stk | 100 | 107 —109 |
| 13,000 | 5 | 2/6 | Gwynnes, Ltd., 5% Cum. Pref. | 5 | 2 — 3 |
| 250,000 | 1 | 3/6 | Hadfield's Steel F'dry Co., Ld., Ord. | 1 | 3 1/16—3 3/16* |
| 20,000 | 10 | 4/6 | Do. 4½% Cum. Pref. | 10 | 10⅜ — 11¼ |
| 30,000 | 5 | 3/- | Hall (J. & E.), Ltd. 6% Cum. Pref. | 5 | 5 — 5½ |
| 408,505 | 1 | 1/6 | Harvey United Steel Co., Ltd. | 1 | 1 5/16—1 7/16* |
| 47,500 | 10 | 7½% | Hawthorn, Leslie & Co., Ltd. Ord. | 10 | 10¾— 11 |
| 28,001 | 5 | 7/- | Head, Wrightson & Co., Ltd. | 5 | 5 — 5¼ |
| 85,000 | 1 | 7½d. | Hill (Richard) & Co. (1899) Ld., Ord. | 1 | ⅜ — 7/16 |
| 18,000 | 5 | 3/- | Do. 6% Cum. Pref. | 5 | 4⅜— 4⅞ |
| 30,000 | 10 | 6/- | Hornsby (Richard) & Sons, Ld., Ord. | 8 | 5½— 6 |

## ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 750,000 | 1 | 6d. | Howard & Bullough, Ltd., Ord. | 1 | 1⅛ — 1⅜ |
| 25,000 | 10 | 6/- | Do. 6% Pref. (Non-Cum.) | 10 | 13 — 13½ |
| £250,000 | Stk | 4% | Do. 4% Deb. Stk., Red. after 1905 | 100 | 98 —101 |
| 37,500 | 10 | 20 | Kynoch, Ltd. | 10 | 18⅜— 19½ |
| 49,587 | 10 | 5% | Do. Cum. Pref. 5% | 10 | 10⅜— 11 |
| 300,000 | 1 | 4¼d | Lambert Bros., Ltd., Ord. | 1 | ⅞— ⅞ |
| 50,000 | 5 | 2/9 | Do. 5½% Cum. Pref. | 5 | 4 — 4¼ |
| 40,000 | 3 | 2/1½ | Leeds Forge Co., 7% Cum. Pref. | 3 | 3⅜— 4½* |
| 200,000 | 1 | 7½d | Lysaght (John), Ltd., 6% Cum. Pf. | 1 | 1 1/16 — 1 1/8 |
| £300,000 | Stk | 4½% | Do 4½% 1st Mt. Deb. Stk., Red. | 100 | 108 —110 |
| 40,000 | 10 | 5/- | Mather & Platt, Ld., 5% Cum. Pref | 10 | 11 —11⅛ |
| 210,000 | 1 | 8⅜d. | Measures Bros., Ltd., Ord. | 1 | 1/16 — 1/16 |
| 75,000 | 1 | 6¾d. | Do. 5½% Cum. Pref. | 1 | ⅞ — 1 |
| £75,000 | Stk | 4½% | Do. 4½% 1st Mrt. Db. Stk., Red. | 100 | 94 — 97 |
| 21,943 | 5 | 2/6 | Muntz Metal, Ltd. | 5 | 5⅛— 5⅜ |
| 14,248 | 5 | 5% | Do. Pref. 5% | 5 | 5 — 5½ |
| 5,000 | 62½ | 47/6 | Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref. | 62½ | 76 — 80 |
| 73,000 | 10 | 5/- | N. Brit. Loco. Co., Ltd., 5% Cm. Pf. | 10 | 11⅜—12⅜* |
| 80,000 | 5 | — | North-Eastern Steel Co., Ltd., Ord. | 5 | — — |
| £250,000 | Stk | 4½% | Do. 4½% 1st Mrt. Db. Stk., Red. | 100 | 90 — 93 |
| 122,000 | 5 | 2/- | Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B" | 5 | 4 — 4¼ |
| 50,000 | 5 | 3/- | Do. 6% Cum. Pref. "A" | 5 | 5⅜ — 6¼ |
| 70,000 | 10 | 6/- | Pease & Partners, Ltd., Ord. | 10 | 10⅝— 11 |
| £400,000 | Stk | 4% | Do. 4% Perp. Deb. Stock | 100 | 97 —100 |
| 20,000 | 5 | 3/- | Peebles (Bruce) & Co., Ld., 6% Cm. P. | 5 | 4⅜— 5 |
| 65,000 | 1 | — | Pooley (Henry) & Son., Ltd., Ord | 1 | 6/- — 6/6 |
| 13,000 | 5 | — | Do. 5½% Cum. Pref. | 5 | 4 — 4¼ |
| 230,000 | 1 | — | Projectile Co. (1902), Ltd., Ord. | 1 | ⅜ — ⅝ |
| 126,938 | 5 | 2/- | Rhymney Iron Co., Ltd. | 5 | 1¼ — 2 |
| 78,062 | 5 | 2/- | Do. New | 5 | 1⅛ — 1⅜ |
| £330,000 | — | 5% | Do. 5% Mort. Deb., Red. | 100 | 101 —103 |
| 350,000 | 1 | 7½d. | Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. | 1 | ¾— 15/16 |
| £350,000 | Stk | 4½% | Do. 4½% Perp. Deb. Stock | 100 | 94 — 96 |
| 35,000 | 10 | 12/- | Ruston, Proctor & Co., Ltd. | 10 | 9½ — 10 |
| 275,000 | 1 | 6d. | Scott (Walter), Ltd., Ord. | 1 | 1/16 — 1/8 |
| 300,000 | 1 | 7½d. | Do. 6% Cum. Pref. | 1 | 1 — 1¼ |
| £300,000 | Stk | 4% | Do. 4% Perp. Deb. Stk. | 100 | 94 — 96 |
| £115,300 | 100 | 5% | Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red | 100 | 92 — 95 |
| £97,900 | 100 | 6% | Do. 6% 2nd Mort. Debs., Red. | 100 | 91 — 95 |
| 250,000 | 1 | 1/- | South Durham Steel & Iron, Ltd. Or. | 1 | ⅜ — 1/2 |
| 300,000 | 1 | 7½d. | Do. 6% Cum. Pref. | 1 | 23/32 — 25/32 |
| £300,000 | Stk | 4½% | Do. 4½% Per. Deb. Stock | 100 | 90 — 93 |
| 49,560 | 10 | 2½% | Steel Co. of Scotland Ord. 1/49560. | 9 | 5 — 5½ |
| £125,240 | Stk. | 5% | Do. 5% Trust Mort. Deb. | 100 | 106½—107½ |
| 25,000 | 10 | — | Stephenson (Robert) & Co., Ltd., Or. | 10 | 2¼ — 2⅝ |
| 25,000 | 10 | 5/6 | Do. 5½% Cum. Pref. | 10 | 4¼ — 4¾ |
| £250,000 | Stk | 4% | Do. 4% Perp. Deb. Stock | 100 | 79— 82 |
| 85,000 | 10 | 9/- | Stewarts & Lloyds, Ltd., Ord. | 10 | 17½— 18 |
| 55,000 | 10 | 6/- | Do. 6% Cum. Pref. | 10 | 14¾— 15½ |
| 634,732 | 1 | 6d. | Swan, Hunter & Wigham-Richardson, Lim. Ord. | 1 | 3/8 — 7/8* |
| 538,845 | 1 | 6d. | Do. 5% Cum. Pref. | 1 | ⅝ — 1* |
| £240,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Red | 100 | 98 — 101 |
| 300,000 | 1 | 6d. | Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf. | 1 | ⅛— 3/16 |
| £200,000 | 100 | 4% | Do. 4% Irredeem. 1st Mort. Deb. | 100 | 67 — 71 |
| £160,000 | 1 | 7½d. | Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref. | 1 | 1/16 — 1 1/16 |
| 10,000 | 10 | 5/- | Tylor (J.) & Sons, Ltd. 5% Cum. Pf. | 10 | 9⅜ — 10 |
| $508495200 | $100 | 8½ | United States Steel Corp. Com. Stk. | $100 | 36⅜ — 36⅝ |
| $360314100 | $100 | 8½ | Do. 7% Cum. Pref. Stock | $100 | 98½ — 98⅝ |
| $162268000 | $1000 | 5% | Do. 10-60yr. 5% Skg. Fd. G. Bds. | $1000 | 98 —100 |
| 3,350,000 | 1 | 1/6 | Vickers, Sons & Maxim, Ltd. Ord. | 1 | 2 7/16—2 9/16* |
| 750,000 | 1 | 6d. | Do. 5% Non-Cum. Pref. | 1 | 1 3/16—1 5/16* |
| £750,000 | Stk | 5% | Do. 5% Non-Cum. Pref. Stock. | 100 | 114 —117* |
| £1,250,000 | Stk | 4% | Do. 4% 1st. Mort. Deb. Stk. Red. | 100 | 106 —108 |
| £1,000,000 | 100 | 4½% | Do. 4½% 2nd Mort. Debs., Red. | 100 | 106 —108 |
| 225,000 | 1 | 1/2½ | Weardale Steel, Coal & Coke, Ltd., Def. Ord. | 1 | 3/8 — 7/8 |
| 500,000 | 1 | 7½d. | Do. 6% Cum. Pref. Ord. | 1 | ⅜ — 1 |
| £300,000 | Stk | 4% | Do. 4% Perpetual Deb. Stock | 100 | 85 — 89 |
| 7,637 | 5 | 2/9 | Weldless Steel Tube, Ltd., Cum. Pref. 5½ | 5 | 4⅜— 4⅝ |
| 300 | Stk | 4½% | Do. Mort. Deb. 4½% | 100 | 91 — 97 |
| 66,666 | 5 | 3/- | Willans & Robinson, Ord. | 5 | 1½ — 2½ |
| 66,666 | 5 | 3/- | Do. 6% Cum. Pref. | 5 | 3 — 4 |
| £246,641 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red | 100 | 78 — 83 |
| £150,000 | Stk | 4½% | Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. | 100 | 81 — 86 |

Stocks and Shares marked * are quoted ex-dividend.

## II.—ELECTRICAL MANUFACTURING COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 70,000 | 1 | 6d. | Alliance Elec. Co., Ltd. 5% Cum. Pf. | 1 | ⅜— ⅝ |
| 125,000 | 1 | 7½d. | Aron Elec. Meter Ltd., 6% Cum. Pf. | 1 | ⅞— ⅞ |
| 120,000 | 1 | 9⅜d. | Bell's Asbestos Co., Ltd. | 1 | ¾— ⅞ |
| 100,000 | 5 | 4/- | British Insulated & Helsby Cables Ltd., Ord. | 5 | 5⅜— 6¼ |
| 100,000 | 5 | 3/- | Do. 6% Cum. Pref. | 5 | 5¼—5⅜ |
| £500,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Rd. | 100 | 101 —104 |
| £200,000 | Stk | 4½% | British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. | 100 | 99 —101 |
| 400,000 | 5 | 3/- | British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. | 5 | 8⅛— 8⅜ |
| £616,353 | Stk | 4% | Do. 4% Mort. Deb. Stk. Red. | 100 | 91 — 93 |
| 105,731 | 1 | 2/- | Brush Elec. Enging. Co., Ltd., Ord. | 2 | ½— ¾ |
| 150,000 | 2 | 2/4⅓ | Do. 6% Pref. | 2 | 1⅛— 1⅛ |
| £125,000 | Stk | 4½% | Do. 4½% Perp. 1st Deb. Stk. | 100 | 92 — 95 |
| £125,000 | Stk | 4½% | Do. 4½% Perp. 2nd Deb. Stk. | 100 | 79 — 82 |
| 35,000 | 5 | 5/- | Callender's Cable & Constn. Ltd. Ord. | 5 | 11 — 11½ |
| 40,000 | 5 | 2/6 | Do. 5 % Cum. Pref. | 5 | 5½— 5⅝ |
| £200,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. Red. | 100 | 106 —108 |
| 85,000 | 3 | 1/6 | Crompton & Co., Ltd. | 3 | 2⅛— 2⅜ |
| £100,000 | — | 5% | Do. 5% 1st Mort. Reg. Debs. | 100 | 93 — 98 |
| 52,000 | 5 | 10/- | Dick, Kerr & Co., Ltd., Ord. | 5 | 8 — 8½ |
| 61,000 | 5 | 3/- | Do. 6% Cum. Pref. | 5 | 5⅞— 6⅛ |
| £300 000 | Stk | 4½% | Do. 4½% Deb. Stock, Red. | 100 | 106 —108 |
| 283,334 | 1 | 6d. | Doulton & Co., Ltd., 5% Cum. Pref. | 1 | 1⅛— 1⅜ |
| £283,334 | Stk | 4% | Do. 1st Mort. 4% Iree. Deb. Stk. | 100 | 106 —109 |
| 99,261 | 1 | 1/6 | Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261 | 1 | 1 — 1¼ |
| 17,139 | 5 | 2/6 | Do. "A" Shares Nos. 01-017,139 | 5 | 1⅞— 2¼ |
| £344,023 | Stk | 4% | Do. 4% Deb. Stock Red. | 100 | 80 — 85 |
| £100,000 | Stk | 5% | Do. 5% Second Deb. Stk. Red. | 100 | 86 — 91 |
| 112,100 | 2 | 1/7½ | Electric Construction Co., Ltd. | 2 | 1⅛— 1⅛ |
| 31,390 | 2 | 2/9⅔ | Do. 7% Cumulative Pref. | 2 | 2⅛— 2⅜ |
| £200,000 | Stk | 4% | Do. 4% Perp. 1st Mt. Deb. Stk. | 100 | 97 — 99 |
| 10,248 | 10 | 7/6 | Evered and Co., Ltd. | 10 | 12 — 14 |
| £100,000 | Stk | 5% | Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red. | 100 | 90 — 95 |
| 25,000 | 10 | 5/- | Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref. | 10 | 9¼— 10 |
| £200,000 | Stk | 4% | Do. 4% 1st. Mt. Deb. Stk., Red. | 100 | 91 — 96 |
| 35,000 | 5 | 10/- | Henley's (W. T.) Telegraph Works Co., Ltd., Ord. | 5 | 12½—13* |
| 35,000 | 5 | 2/3 | Do. 4½% Cum. Pref. | 5 | 5⅝— 5⅞ |
| £50 000 | Stk | 4½% | Do. 4½% Mt. Deb. Stk. Red. | 100 | 109—111 |
| 50,000 | 10 | 5/- | India Rubber, Gutta Percha & Telegraph Works Co., Ltd., | 10 | 16 — 17 |
| £300,000 | 100 | 4% | Do. 1st Mort. Deb. Red. | 100 | 100 —103 |
| 7,500 | 10 | — | Parker, Thos., Ltd. | 10 | 6½— 7 |
| 100,000 | 1 | 3% | Scott (Ernest) & Mountain, Ld., Ord. | 1 | 16/—17/- |
| 37,350 | 12 | 24/- | Telegraph Construction and Maintenance Co., Ltd. | 12 | 36 — 38* |
| £150,000 | 100 | 4% | Do. 4% Deb. Bonds | 100 | 103 —105 |

## III.—ELECTRIC TRACTION.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 120,000 | 5 | 3/- | Anglo-Argentine Trams Co., Ld., Or. | 5 | 8½— 8⅝ |
| 260,007 | 5 | 2/6 | Do. 5% Cum Pf. | 5 | 5⅝— 5⅞ |
| £230,000 | Stk | 6% | Do. Permanent 6% Debenture Stock, 1888 | 100 | 140 —143 |
| 20,000 | 10 | 6/- | Barcelona Trams Co., Ltd., Ord. | 10 | 12 — 12½ |
| 10,000 | 10 | 5/- | Do. 5% Cum Pf. Shares | 10 | 9 — 10 |
| £46,300 | 100 | 5% | Do. 5% Debs., Red. | 100 | 99 —102 |
| £191,326 | Stk | 4½% | Do. 4½% Red. Deb. Stk. | 100 | 96 —100 |
| 75,606 | 1 | — | Bath Elec. Trams. Ld., Pf. Or. | 1 | 1⅛— 1⅛ |
| 59,394 | 1 | 11·49d | Do. 5% Cum. Pf. | 1 | 1⅛— 1⅛ |
| 75,000 | 5 | — | Brisbane Electric Tram Investment Co., Ltd., Ord. | 5 | 1 — 1½ |
| 75,000 | 5 | 2/6 | Do. 5% Cum. Pf. | 5 | 3¾— 4¼ |
| £425,000 | Stk | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 94 — 98 |
| £200,000 | Stk | 6% | Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock | 100 | 103 —106 |
| | | % | Pref. Ord. Stock | 100 | 100 —103 |
| 133,301 | 10 | 6/- | Brit. Electric Traction, Ltd., Ord. | 10 | 9½— 9⅝ |
| 156,487 | 10 | 6/- | Do. 6% Cum. Pref. | 10 | 10⅝—11⅛ |
| £1,000,000 | Stk | 5% | Do. 5% Perp. Deb. Stk. | 100 | 122 —124 |
| £250,000 | Stk | 4½% | Do. 4% 2nd Deb. Stk. Red. | 100 | 98 —100 |
| 100,000 | 5 | 1/6 | Buenos Ayres & Belgrano Electric Trams, Ltd., Ord. | 5 | 3⅜— 4 |
| 40,500 | 5 | 3/- | Do. "A" 6% Cum Pref. | 5 | 5⅝— 5⅞ |
| 27,000 | 5 | 3/- | Do. "B" do. | 5 | 5⅝— 5⅝ |

## ELECTRIC TRACTION.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £200,000 | Stk | 5% | Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red. | 100 | 95 — 98 |
| £220,000 | 100 | 6% | Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds. | 100 | 103 —106 |
| 102,268 | 5 | 3/- | Calcutta Tramways Co., Ltd. | 5 | 8½— 8⅝ |
| £350,000 | Stk | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 106 —108 |
| 480,000 | 1 | 6d. | Cape Electric Tramways, Ltd. | 1 | 1⅛— 1⅛ |
| 40,000 | 5 | 2/6 | City of Birmingham Trams Co., Ltd. 5 % Cum. Pref. | 5 | 4⅞— 5⅛ |
| £300,000 | 100 | 4% | Do. 4% 1st Mort. Debs. | 100 | 101 —104 |
| £120,000 | Stk | 5% | Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red. | 100 | 103 —105 |
| 60,000 | 10 | 6/- | Dublin United Trams. Co. (1896), Ltd., Ord. | 10 | 13 — 14 |
| 59,987 | 10 | 6/- | Do. 6% Pref. | 10 | 15⅛— 16½ |
| 30,000 | 5 | 2/6 | Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref. | 5 | 3 — 3½ |
| £150,000 | Stk | 4% | Do. 4% Deb. Stock. | 100 | 89 — 92 |
| 125.000 | 10 | 5/- | London United Trams. (1901), Ltd., 5% Cum. Pref. | 10 | 10 —10½ |
| £1.031,000 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red. | 100 | 99 —102 |
| £50,000 | Stk | 5% | Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red. | 100 | 101 —103 |
| 314,016 | 1 | — | Metropolitan Elec. Trams, Ltd., Def. | 1 | 1/32— 1/32 |
| 500,000 | 1 | 6d. | Do. 5% Cum. Pref. | 1 | 1 1/32— 1 3/32 |
| £350,000 | Stk | 4½% | Do. 4½% Deb. Stock, Red. | 100 | 105 —107 |
| 50,000 | 5 | 5/- | New General Traction Co., Ltd., 6% Cum. Pref. | 5 | ¾— 1½ |
| 110,923 | 8 | 3/2⅔ | North Metropolitan Tramways Co. | 8 | 3⅜— 4¼ |
| £150,000 | 100 | 3½% | Do. 3½% Mort. Debs. | 100 | 90 — 95 |
| £196,200 | Stk | 5% | Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red. | 100 | 104 —107 |
| 24,500 | 10 | 10/- | Potteries Elec. Traction Co., Ld., Or. | 10 | 9¼— 10 |
| 24,500 | 10 | 5/- | Do. 5% Cum. Pref. | 10 | 9¼— 9⅜ |
| £220 000 | Stk | 4½% | Do. 4½% Deb. Stk., Red. | 100 | 102 —105 |

## IV.—ELECTRIC LIGHTING AND POWER.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 7,500 | 10 | 16/- | Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. | 10 | 12½— 12⅝ |
| 7,500 | 10 | 4/6 | Do. 4½% Cum. Pref. | 10 | 9¾— 10½ |
| 7,500 | 10 | 6/- | Do. 6% Cum. Second Pf. | 10 | 11 — 12 |
| £70,000 | Stk | 4½% | Do. 4½% Deb. Stock Red | 100 | 105 —107 |
| 14,000 | 5 | 2/- | Bromley (Kent) Elec. Lt. & Pr. Co., Ld | 5 | 5½— 5⅝ |
| £50,000 | Stk | 4½% | Do. do. 4½% 1st Deb. Stk. Red. | 100 | 101 —104 |
| 27,507 | 5 | 4/6 | Brompton & Kensington Elec. Supply Co., Ltd. Ord. | 5 | 10½— 10⅝ |
| 12,493 | 5 | 3/6 | Do. 7% Cum. Pref. Shares | 5 | 10 — 10½ |
| 60,000 | 5 | 3/- | Calcutta Elec. Sup. Cor. Ltd., Ord. | 5 | 9 — 9¼ |
| £288,782 | Stk | 4% | Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. | 100 | 105 — 108 |
| 70,000 | 5 | 4/- | Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord. | 5 | 8 — 8½ |
| 80,000 | 5 | 2/3 | Do. do. 4½% Cum. Pref. | 5 | 5½— 5⅝ |
| £350,000 | Stk | 4% | Do. do. 4% Deb. Stk. Red. | 100 | 105 —107 |
| 44,436 | 5 | 3/9 | Chelsea Elec. Sply. Co., Ltd., Ord. | 5 | 6¾— 7¼ |
| £150,000 | Stk | 4½% | Do. do. 4½% Deb. Stk., Red | 100 | 109 —111 |
| 70,595 | 10 | 7/- | City of London El. Lghtg. Co., Ld., O. | 10 | 11⅞—12½* |
| 40,000 | 10 | 6/- | Do. 6% Cum. Pref. | 10 | 13½— 14* |
| £400,000 | Stk | 5% | Do. 5% Deb. Stk., Red | 100 | 123 —127 |
| £300,000 | Stk | 4½% | Do. 4½% 2nd Deb. Stk., Red | 100 | 103 —105 |
| 40,000 | 10 | 4/- | County of London Elec. Supply Co., Ltd., Ord. | 10 | 9½— 10 |
| 30,000 | 10 | 6/- | Do. 6% Cum. Pref. | 10 | 12½— 12¾ |
| £400,000 | Stk | 4½% | Do. 4½% Deb. Stk., Red. | 100 | 110 —113 |
| 70,000 | 5 | 2/6 | Edmundson's Elec. Cor. Ltd., Ord. | 5 | 6⅜— 6⅝ |
| 70,000 | 5 | 3/- | Do. 6% Cum. Pref. | 5 | 6⅜— 6⅝ |
| £300,000 | Stk | 4½% | Do. 4½% 1st Mort. Db. Stk. Reg | 100 | 106 —108 |
| £80,000 | Stk | 5% | Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red. | 100 | 86 — 91 |
| 10,000 | 5 | 2/- | Folkestone Elec. Supply Co., Ld., O. | 5 | 5½— 6 |
| £50,000 | Stk. | 4½% | Do. 4½% 1st Deb. Stk., Red. | 100 | 101 —104 |
| 15,000 | 10 | — | Havana Electricity Co., Ltd. | 10 | 9⅞—10⅛ |
| 13,000 | 5 | 3/6 | Hove Elec. Lighting Co., Ltd., Ord. | 5 | 7¾— 8¼ |
| £50,000 | Stk | 4½% | Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red. | 100 | 101—103 |
| 150,000 | 1 | — | Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref. | 1 | ⅝— ¾ |
| 21,000 | 5 | 7/- | Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. | 5 | 12⅜—13½ |

Stocks and Shares marked * are quoted ex-dividend.

## ELECTRIC LIGHTING AND POWER.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £135,000 | Stk | 4% | Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red. | 100 | 102 —104 |
| 111,000 | 3 | 1 9/32 | London Elec. Supply Corp., Ld., Ord. | 3 | 2 9/16 — 2 11/16 |
| 60,000 | 5 | 3/- | Do. 6% Pref. .. .. .. | 5 | 5 3/8 — 6 |
| £371,895 | Stk | 4% | Do. 4% 1st Mort. Db. Stk., Red. | 100 | 99 —101 |
| 100,000 | 10 | 11/- | Metropolitan Elec. Sup. Co., Ld., Or. | 10 | 18 1/2 —18 3/4* |
| 76,121 | 5 | 2/8 | Do. 4½% Cum. Pref. .. .. | 5 | 5 3/8 — 5 5/8 |
| 220,000 | Stk | 4½% | Do. 4½% 1st Mort. Db. Sk., Red. | 100 | 110 —115 |
| 250,000 | Stk | 3½% | Do. 3½% Mort. Deb. Stk., Red. | 100 | 97 — 99 |
| £250 000 | — | 4½% | Midland Elec. Corp. for Power Distribution. Ld., 4½% 1st Mort. Deb. | 100 | 97 —100 |
| 10,852 | 10 | 8/-* | Notting Hill Elec. Ltg. Co. Ltd. Ord. | 10 | 14½—15½* |
| £59,000 | 100 | 4% | Do. 4% 1st Mort. Debs. .. | 100 | 102 —104 |
| 16,500 | 5 | 4/6 | Oxford Electric Co. Ltd., Ord. .. | 5 | 6 1/8 — 6 3/8* |
| £50,000 | Stk | 4% | Do. 4% Debenture Stk. Red. | 100 | 98 —100 |
| £84,700 | 100 | 4½% | Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb | 100 | 100 —102 |
| 40,000 | 5 | 9/6 | St. James' & Pall Mall Elec. Light Co., Ltd. Ord. | 5 | 14 —14½ |
| 20,000 | 5 | 3/6 | Do. 7% Pref. .. .. .. | 5 | 8½— 8¾ |
| £150,000 | Stk | 3½% | Do. 3½% Deben. Stock, Red | 100 | 98 —100 |
| 12,000 | 5 | 4/- | Smithfield Markets Elec. Supply Co., Ltd. Ord. | 5 | 2 5/8 — 3 1/8 |
| £50,000 | Stk | 4% | Do. 4% Debenture Stk. Red. | 100 | 79 — 83 |
| 65,000 | 5 | 4/- | South London Elec. Sup. Co., Ltd. O. | 5 | 4 1/8 — 4 3/8* |
| 100,000 | 1 | — | South Metropolitan Elec Light & Power Co., Ltd. Ord. | 1 | 7/8 — 1 |
| 50,000 | 1 | 8 3/4d. | Do. 7% Cum. Pref. .. .. | 1 | 1 5/16—1 7/16* |
| £100,000 | Stk | 4½% | Do. 4½% 1st Deb. Stock Red. | 100 | 107 —110 |
| 50,000 | 5 | 2/6 | Urban Electric Supply Co., Ltd., O. | 5 | 5 1/16—5 3/16 |
| 30,000 | 5 | 2/6 | Do. 5% Cum Pref. .. .. | 5 | 5 1/8 — 5 1/4 |
| £200,000 | Stk | — | Do. 4½% 1st Mort. Deb. Stk. Red | 100 | 106 —108 |
| 110,000 | 5 | 7/6 | Westminster Elec. Supply Corp. Ltd., Ord. | 5 | 12 3/8 —13 1/8 |
| 28,151 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 6 1/2 — 6 3/4 |

## V.—TELEGRAPH & TELEPHONE COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| £34,800 | 100 | 4% | African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red. .. .. | 100 | 99 —102 |
| 25,000 | 10 | — | Amazon Telegraph Co., Ld... .. | 10 | 2 1/2 — 2 3/4 |
| £763,580 | Stk | 17/6 | Anglo-American Tel. Co.. Ltd., Ord. | 100 | 61 — 63 |
| £3,118,210 | Stk | 35/- | Do. 6% Preferred Ordinary | 100 | 108 1/2—109 1/2 |
| £3,118,210 | Stk | 2/- | Do. Deferred Ordinary .. | 100 | 17 1/8 — 17 3/8 |
| 44,000 | 5 | 3/- | Chili Telephone Co., Ltd. .. .. | 5 | 6 3/8 — 6 5/8 |
| $15,000,000 | $100 | $2 | Commercial Cable Co., Capital Stk. | $100 | 230 —240 |
| £1,903,856 | Stk | 4% | Do. Sterl. 500-yr 4% Deb. Stk., Red. | 100 | 98 —100 |
| 16,000 | 10 | 5/- | Cuba Submarine Tel. Co., Ld., Ord. | 10 | 8 3/4 — 9 1/2 |
| 6,000 | 10 | 10/- | Do. 10% Preference .. .. | 10 | 17 — 18 |
| 6,000 | 5 | 2/- | Direct Spanish Telegraph Co., Ord. | 5 | 3 3/8 — 3 5/8 |
| | | 5/- | 10% Cum. Preference | 5 | 8 1/2 — 8 3/4 |
| £30,000 | 50 | 4½% | Do. 4½% Debs... .. .. | 50 | 101-103% |
| 60,710 | 20 | 3/- | Direct U.S. Cable Co., Ltd... .. | 20 | 11 3/8—11 5/8 |
| £85,800 | 100 | 4½% | Direct West India Cable Co., Ltd., 4½% Reg. Debs. | 100 | 100—102 |
| £300,000 | 100 | 4% | East. & S. African, Ld., 4% Mt. Dbs. | 100 | 100—102 |
| £200,000 | 25 | 4% | Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy).. | 25 | 101-103% |
| 300,000 | 10 | 2/6 | Eastern Extension, Australasia and China, Ltd... | 10 | 14 1/2— 15 |
| £602,400 | Stk | 4% | Do. 4% Mort. Deb. Stk., Perp. | 100 | 105 —107 |
| £1,000,000 | Stk | 25/- | Eastern Tele. Co., Ltd., Ord. .. | 100 | 145 —148 |
| £2,000,000 | Stk | 17/6 | Do. 3% Pref. .. .. .. | 100 | 92 — 94 |
| £1,836,814 | Stk | 4% | Do. 4% Mort. Deb. .. .. | 100 | 107 —109 |
| 150,000 | 10 | 5/- | Great Northern Telegraph Co., Ltd., (of Copenhagen) .. | 10 | 34 1/2— 35 1/2 |
| £58,700 | 100 | 4½% | Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red. | 100 | 100—102 |
| 17,000 | 25 | 12/6 | Indo-European Tele. Co., Ltd. .. | 25 | 47 — 49 |
| 72,680 | 1 | 7 1/2d. | Monte Video Telephone Co., Ltd., O. | 1 | 13/16— 15/16 |
| £1,983,333 | Stk | 6% | National Telephone Co., Ltd., Pref. | 100 | 110 —111* |
| £1,966 667 | Stk | 5% | Do. Deferred .. .. .. | 100 | 104—106* |
| 250,000 | 5 | 2/6 | Do. 5% Non-Cum. 3rd Pref. | 5 | 5 3/8 — 5 5/8* |
| £2,000,000 | Stk | 3½% | Do. 3½% Deb. Stk., Red. .. | 100 | 100—102 |
| £689,593 | Stk | 4% | Do. 4% do. do. .. | 100 | 104 —106 |
| 179,313 | 1 | 7½d. | Oriental Telephone & Elec. Co., Ltd. | 1 | 1 1/4 — 1 3/8 |
| 50,000 | 1 | 7½d. | Do. 6% Cum. Pref. .. .. | 1 | 1 3/16 — 1 5/16 |
| £100,000 | 100 | 4% | Pacific & European Tel. 4% Guar. Debs. Red... | 100 | 98 —101 |
| 11,839 | 8 | 4/- | Reuter's Telegram Co., Ltd. .. | 8 | 7 1/4 — 7 3/4 |
| 58,000 | 5 | 3/- | United River Plate Telep. Co., Ltd. | 5 | 7 1/2 — 7 3/4 |
| 40,000 | 5 | 2/6 | Do. 5% Cum. Pref. .. .. | 5 | 5 — 5 1/4 |
| £179,947 | Stk | 5% | Do. 5% Deb. Stock, Red. .. | 100 | 107—109 |
| 15,609 | 10 | 4/- | W. African Telegraph Co., Ltd. .. | 10 | 8 — 8 1/4 |
| £30,008 | 2½ | — | West Coast of America, Ltd. .. | 2 1/2 | 1/16— 1/8 |
| 150,000 | 100 | 4% | Do. 4% Deb. Guar. by West. Tel. | 100 | 100 — 102 |

## TELEGRAPHS AND TELEPHONES.—*Contd.*

| Present Amount Subscribed. | Shares. | Last Dividend. | Name | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 88,321 | 10 | 6d. | W. India & Panama Teleg. Co., Ld., Or. | 10 | 7/8 — 1 |
| 84,568 | 10 | 6/- | Do. 6% Cum. 1st. Pref. .. | 10 | 8 1/2 — 9 |
| 4,669 | 10 | 6/- | Do. 6% Cum. 2nd Pref. .. | 10 | 8 1/4 — 8 3/4 |
| £80,000 | 100 | 5% | Do. 5% Deb. .. .. .. | 100 | 103 —105 |
| 207,930 | 10 | 8/- | Western Telegraph Co., Ltd. .. | 10 | 14 — 14 1/2 |
| £75,000 | 100 | 5% | Do. 5% Debs., 2nd Series, 1906 | 100 | 101 —103 |
| 518,945 | Stk | 4% | Do. 4% Deb. Stock, Red. .. | 100 | 103 —105 |

## VI.—SHIPPING COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 32,500 | 10 | 5/6 | Anchor Line (Henderson Bros.), Ltd., 5% Cum. Pref. | 10 | 8 1/2— 9 |
| £325,000 | Stk | 4½% | Do. 4½% Red. 1st Mort. Deb. Stk. | 100 | 99 —101 |
| £672,900 | Stk | 4½% | British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red. | 100 | 93 — 95 |
| 40, 000 | 10 | 5/6 | Bucknall Steamship Lines, Ltd., 5½% Cum. Pref. | 10 | 6 — 6 1/2 |
| £600,000 | Stk | 4½% | Do. 4½% 1st Mort. Deb. Stk. | 100 | 75 — 78 |
| £750,000 | Stk | 4½% | Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. .. | 100 | 98 —100 |
| 60,000 | 20 | 16/- | Cunard Steam Ship Co., Ltd., Nos. 1-60,000.. | 20 | 13 3/4 — 14 1/4 |
| 40,000 | 20 | 8/- | Do. Nos. 60,001-100,000 | 10 | 5 1/8 — 6 1/4 |
| £451,480 | Stk | 4½% | Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. .. | 100 | 101 —103 |
| 1,200,000 | 1 | 6d. | Furness, Withy & Co., Ltd., Ord... | 1 | 1 3/16—1 5/16 |
| 25,328 | 7½ | 4/7 | Gen. Steam Navigation Co., Ld., Ord. | 7½ | 4 1/2 — 4 3/4 |
| 36,758 | 8 | 4/9 3/8 | Do. Non-Cum. 6% Pref. .. .. | 8 | 7 1/2 — 8 |
| £150,000 | Stk | 4% | Do. 4% 1st Mort. Deb. Stk. Red. | 100 | 99 —101 |
| 55,000 | 5 | 1/3 | Houlder Line, Ltd., Ord. .. .. | 5 | 2 1/2 — 3 |
| 40,000 | 5 | 2/9 | Do. 5½% Cum. Pref. .. .. | 5 | 3 1/4 — 3 3/4 |
| £200,000 | Stk | 4½% | Do. 4½% 1st Mt. Deb. Stk. Red. | 100 | 83 — 86 |
| 141,500 | 10 | 5/- | Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. .. | 10 | 5 1/2 — 5 3/4 |
| £1,160,000 | Stk | 5 % | Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. .. | 100 | 131 —134 |
| £1,160,000 | Stk | 19% | Do. do. Deferred .. | 100 | 228 —231 |
| 15,000 | 100 | 30/- | Royal Mail Steam Packet Co. Ord.. | 60 | 25 1/2— 26 1/2 |
| 39,075 | 5 | 2/6 | Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref.. | 5 | 4 3/4— 5 1/4 |
| 39,075 | 5 | 2/6 | Do. "B" Ord... .. .. | 5 | 4 — 4 1/4 |
| 141,841 | 10 | 4/- | Union Castle Mail Steamship Co., Ltd., Ord.. | 10 | 8 1/2— 8 3/4 |
| 24,000 | 10 | 4/6 | Do. 4½% Cum. Pref... .. | 10 | 10 1/2— 10 3/4 |
| £1,008,894 | Stk | 4% | Do. 4% Debenture Stk., Red. | 100 | 99 —101 |

## VII.—MISCELLANEOUS COMPANIES.

| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 60,000 | 1 | 9 3/4d. | Chadburn's (Ship) Tele. Ltd., Ord... | 1 | 7/8— 1 1/8 |
| £750,000 | Stk | 9% | General Hydraulic Power Co., Ltd. | 100 | 128 —133* |
| 12,500 | 10 | 10/- | Oakey (John) and Sons, Ltd., Ord.. | 10 | 24 — 26 |
| 10,000 | 10 | 6/- | Do. do. 6% Cum. Pf. | 10 | 14 — 15 |
| 183,538 | 1 | 6 3/4d. | Power Gas Corp., Ltd., Ord., Nos. 66,463-250 .. .. .. .. | 15/- | 5/16— 7/16 |
| 66,462 | 1 | 8 1/4d. | Do. do. Nos. 1 66,462 | 1 | 13/16— 15/16 |
| 135,000 | 1 | 6d. | Waygood (R.) & Co., Ltd., Ord. .. | 1 | 1 1/16— 1 1/16 |
| 135,000 | 1 | 7½d. | Do. 6% Cum. Pref. ... | 1 | 1 1/8— 1 1/4 |

## RAILWAY CARRIAGE & WAGON COMPANIES.

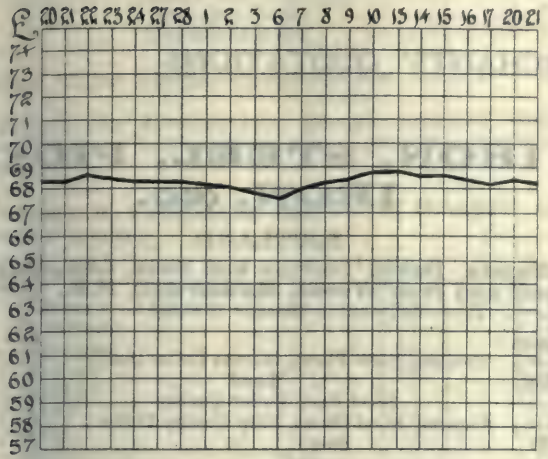
| Present Amount Subscribed. | Shares. | Last Dividend. | Name. | Paid up. | Closing Prices. |
|---|---|---|---|---|---|
| 10,000 | 10 | 7/6 | Birm. Railway-Car, & Wagon, L., 1-10,000 | 10 | 21 —22 |
| 8,739 | 10 | 3/- | Do. Second Issue 1-8,739.... | 4 | 8 3/4— 9 |
| 10,000 | 10 | 6/- | Do. Cum. Pref. 6% 1-10,000.. | 10 | 13 —13 1/2 |
| 30,111 | 7 | 7/- | Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000 | 7 | 9 — 9 1/2 |
| 44,889 | 7 | 3/6 | Do. B, 29,862-49,750, 50,001-75,000 | 7 | 3 7/8— 4 1/8 |
| 14,567 | 10 | 1/3 | Lancashire Wagon, Ord. .. .. | 2 | 2 1/16—2 5/16 |
| 4,150 | 10 | 5% | Do. do. .. .. | 10 | 10 1/2—10 3/4 |
| 784,808 | 1 | 9d. | Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808 | 1 | 41/9—42/3 |
| 164,288 | 1 | 6d. | Do. Cum. A Pref. 5% 1-164,288 | 1 | 23/6 —24/6 |
| 235,000 | 1 | 7½d. | Do. Cum. B Pref. 6% 1-235,000 | 1 | 27/6 —28/6 |
| 20,000 | 20 | 20/- | Midland Rail.-Car. & Wagon, Ld., 1-20,000 | 10 | 18 3/4—19 1/2 |

Stocks and Shares marked * are quoted ex-dividend.

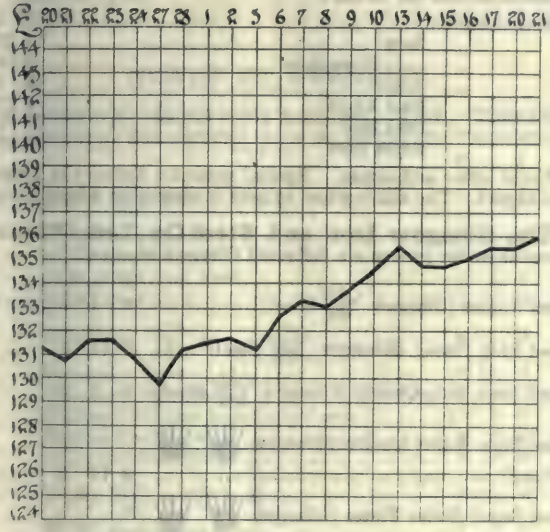
# THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM FEBRUARY 20TH TO MARCH 21ST, 1905.

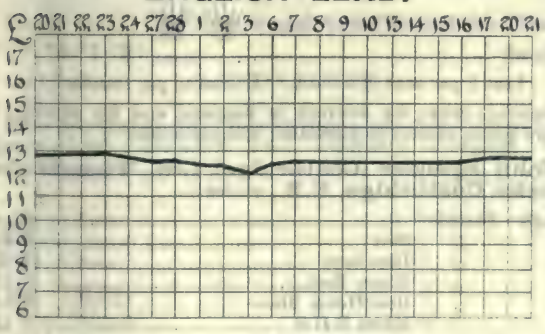
## COPPER.



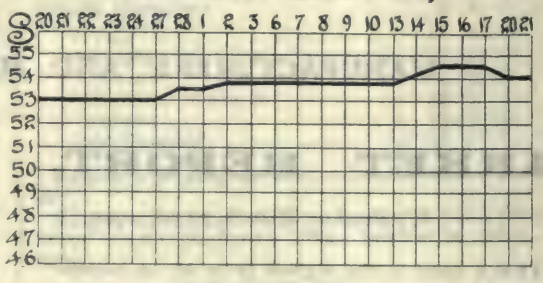

## TIN.



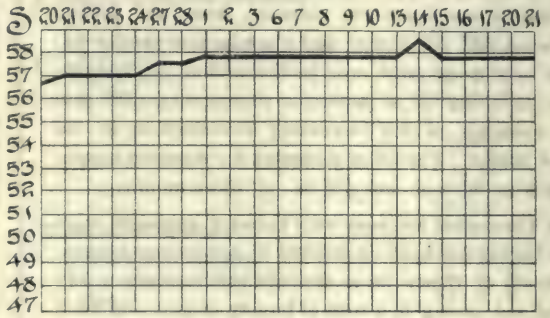

## ENGLISH LEAD.



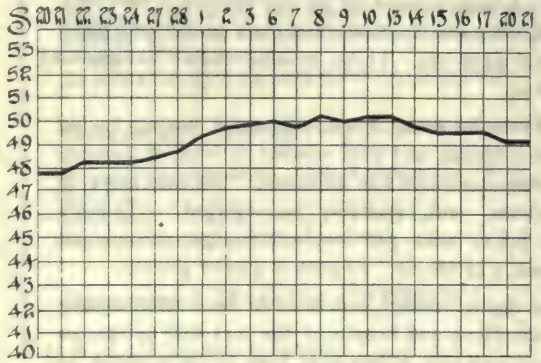

## PIG IRON: SCOTCH,



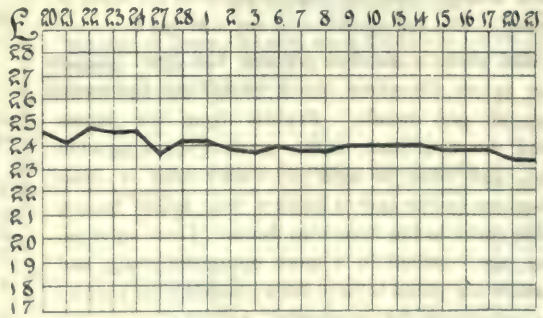

## HEMATITE.




## CLEVELAND.




## SPELTER.



# PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

## MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

## MARKET REPORT.

*Wednesday, March 22nd, 1905.*

AFTER a spurt to the highest price of the present year the Copper market has quieted down. The situation is not materially different, American advices still being very favourable, and it is tolerably certain that stocks in Europe must now be lower than the average, while the falling off of American shipments to this side is an evidence of the increasing consumption in the United States. The price yesterday for standard copper was £68 2s. 6d. cash and £68 8s. 9d. three months.

The Tin market has been very buoyant although most of the buying has been on account of continental houses. The stock of Banca tin in Holland has been practically cleared out owing to a rush of buying orders, and most of the metal went at a considerable advance over London parity. A large account for the rise appears to have been opened, and a sharp advance took place to-day, cash metal touching £136 5s. Three months' metal is quoted £134 15s.

Lead remains steady, some fairly good buying having been in evidence, and with smaller arrivals in London the statistical position has improved. The next move in the market will probably be upward. To-day's closing prices were £12 10s. soft foreign, prompt, and May-June, £12 12s. 6d. English is quoted £12 15s.

In the Spelter market, orders have been filled at very moderate prices, and in spite of the fact that producers are pretty well sold, sellers have been in the majority, so that some decline from the highest prices of the week is to be noted. The last quotation to-day was 23¼ ⅜.

Iron and steel is steady; pig-iron has been quieter at lower prices, Cleveland being quoted 49s. 6½d. cash, and 49s. 9d. one month. Reports from the States described the condition of the markets as somewhat irregular, and these brought in their train a crop of realisations on the part of holders who began to fear a possible check to the American boom. Later advices, however, are couched in a more optimistie strain, and large orders are stated to have been placed by the leading railway companies for equipment, with the result that the process of realisation has practically ceased. Reports from our own trade centres are not quite so encouraging.

## IRON, STEEL, PIG-IRON, &c.

### SCOTLAND.

**Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B.,** quote as follows. Prices delivered in Glasgow or equal:—

| | | £ | s. | d. |
|---|---|---|---|---|
| **Steel:** | | | | |
| DALZELL | Siemens' Steel Plates, Marine Boiler Quality .. | 6 | 15 | 0 |
| | ,, ,, ,, Land ,, ,, ... | 6 | 17 | 6 |
| STEEL | ,, Steel Bars, Boiler Quality ..... | 6 | 17 | 6 |
| DALZELL | Siemens' Steel Plates, Ship Quality Plates..... | 5 | 17 | 6 |
| | ,, ,, Bars ,, ,, ..... | 6 | 7 | 6 |
| STEEL | ,, ,, Angles..... | 5 | 7 | 6 |
| **Manufactured Iron:** | | | | |
| **Bars**—Dalzell | | 6 | 2 | 6 |
| ,, Best | | 6 | 12 | 6 |
| ,, ,, Horseshoe | | 6 | 12 | 6 |
| ,, Angle | | 6 | 2 | 6 |
| ,, Best Angle | | 6 | 12 | 6 |
| ,, Best Best | | 7 | 2 | 6 |
| ,, Extra Best | | 7 | 12 | 6 |

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

**The Glasgow Iron and Steel Co., Ltd., Wishaw,** quote as under (prices are delivered Glasgow or equal):—

| | £ | s. | d. | |
|---|---|---|---|---|
| Steel Angles (Glasgow Steel) | 5 | 7 | 6 | per ton |
| Steel Ship Plates (Glasgow Steel) | 5 | 17 | 6 | ,, |
| Steel Bars, Ship Quality (Glasgow Steel) | 6 | 7 | 6 | ,, |
| Steel Bars, Boiler Quality (Glasgow Steel) | 6 | 17 | 6 | ,, |
| Steel Land Boiler Plates (Glasgow Steel) | 6 | 7 | 6 | ,, |
| Steel Marine Boiler Plates (Glasgow Steel) | 6 | 7 | 6 | ,, |

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

**John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B.,** quotes:—

| | £ | s. | d. |
|---|---|---|---|
| **Bars**—Phœnix | 6 | 5 | 0 |
| ,, Best | 6 | 15 | 0 |
| ,, Best Best | 7 | 5 | 0 |
| ,, Extra Best | 7 | 15 | 0 |
| ,, Best Horse Shoe | 6 | 15 | 0 |
| ,, Extra B.H.S. | 7 | 15 | 0 |
| ,, Extra Best Cable .. .... | 8 | 5 | 0 |
| ,, Rivet | 6 | 5 | 0 |
| ,, Best Scrap Rivet ..... | 7 | 5 | 0 |

| | £ s. d. |
|---|---|
| **Angles**—Phœnix | 6 5 0 |
| ,, Best | 6 15 0 |
| ,, Extra Best | 7 5 0 |
| **Gas Tube Hoops**—Phœnix Best | 6 15 0 |
| **Plates**—Phœnix | — |
| ,, Best Boiler | 7 10 0 |
| ,, Best Best Boiler | 8 0 0 |
| ,, Extra Best Boiler | 9 0 0 |
| **Boiler Tube Strips**—Phœnix Best Best | 8 0 0 |

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

**Messrs. R. Feldtmann and Co., of Glasgow,** quote Commission extra).

| **Pig Iron:** | No. 1. £ s. d. | No. 3. £ s. d. |
|---|---|---|
| Coltness, f.a.s. Glasgow | 3 4 6 | 2 14 0 |
| Gartsherrie ,, | 2 19 0 | 2 14 0 |
| Summerlee ,, | 2 19 0 | 2 14 0 |
| Carnbroe ,, | 2 16 6 | 2 12 6 |
| Langloan ,, | 3 4 0 | 2 15 0 |
| Calder ,, | 2 19 0 | — |
| Clyde ,, | 2 18 6 | 2 13 6 |
| Glengarnock, f.o.b. Ardrossan | 2 18 0 | 2 12 6 |
| Eglinton ,, ,, | 2 14 6 | 2 12 6 |
| Dalmellington, ,, Ayr | 2 14 6 | 2 12 6 |
| Shotts ,, Leith | 2 19 0 | 2 14 6 |

## NORTH OF ENGLAND.

**Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton,** quote as follows, at works:—

| | £ s. d. |
|---|---|
| W.W. Bars | 6 12 6 |
| W.W. Best Bars | 7 2 6 |
| W.W. Best Best | 7 12 6 |
| W.W. Best Best Best | 8 2 6 |
| W.W. Best Shoe | 7 2 6 |
| Thornaby | 8 2 6 |
| Thornaby Best | 8 12 6 |
| Thornaby Best Best | 9 12 6 |
| Whitwell Special Admiralty Cable | 10 5 0 |
| Special Chain Iron | 9 5 0 |
| Tube and Nail Strips | 6 15 0 |
| W.W. Angle Iron | 6 15 0 |
| W.W. Best Angle Iron | 7 5 0 |
| Tee Iron, to 8-inches United | 7 12 6 |

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

## LANCASHIRE.

**The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington,** quote:—

| | | Iron. £ s. d. | Steel. £ s. d. |
|---|---|---|---|
| | Bars | 6 10 0 | 7 5 0 |
| (BNF) | Angles | 7 0 0 | 7 5 0 |
| | Tees | 7 10 0 | 7 15 0 |
| | Hoops | 7 0 0 | 7 10 0 |
| W.I.W | Sheets | 7 10 0 | 8 0 0 |

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

## WORCESTERSHIRE.

**Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport,** quote:—

| **Black Sheets:** | Singles 20 G 96in. by 36in. per ton. £ s. d. | Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d. |
|---|---|---|
| "Vale" | 10 0 0 | 10 10 0 |
| "Shield" | 10 10 0 | 11 10 0 |
| "Severn" | 11 10 0 | 12 10 0 |
| "Baldwin Wilden B." | 12 10 0 | 13 10 0 |
| Charcoal | 16 10 0 | 17 10 0 |
| Best Charcoal | 18 10 0 | 19 10 0 |

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

| **Patent Coated Sheets:** | £ s. d. | £ s. d. |
|---|---|---|
| No. 3 Lead | 13 10 0 | 14 10 0 |
| S.V. Lead | 15 0 0 | 16 0 0 |
| No. 3 Terne | 15 0 0 | 16 0 0 |
| S.V. Terne | 16 10 0 | 17 10 0 |

| **Tinned Sheets:** | Singles 20 G to 108 by 36in. per ton. £ s. d. | Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d. |
|---|---|---|
| Best Coke (Finish) | 28 0 0 | 29 10 0 |
| ,, Charcoal (Finish) | 30 0 0 | 31 10 0 |
| Extra ,, ,, | 32 0 0 | 33 10 0 |

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works less 2½% for cash monthly, 10th inst.

**Galvanized Corrugated Sheets:**

| | £ s. d. | |
|---|---|---|
| "Phœnix" Brand, 24 G., f.o.b. London, in Bundles | 11 12 6 | per ton. |
| "Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London | 14 5 0 | ,, |

**Galvanized Working Up-Sheets:**

| | £ s. d. | |
|---|---|---|
| 24 G., f.o.b. London, in Bundles | 13 12 6 | per ton. |

## STAFFORDSHIRE.

**Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London,** quote:—

| | £ s. d. | |
|---|---|---|
| Crown Bars | 6 10 0 | per ton. |
| Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares) | 7 0 0 | ,, |
| Angles | 6 15 0 | ,, |
| ,, Best | 7 5 0 | ,, |
| T's | 7 0 0 | ,, |
| ,, Best | 7 10 0 | ,, |
| Best Shoe Iron | 8 0 0 | ,, |
| ,, Rivet Iron | 8 0 0 | ,, |
| ,, Best Rivet (Special) | 9 5 0 | ,, |
| ,, Cable | 9 5 0 | ,, |
| ,, Screwing | 8 5 0 | ,, |

| | £ | s. | d. | |
|---|---|---|---|---|
| Best Turning | 8 | 0 | 0 | per ton. |
| ,, Plating | 8 | 5 | 0 | ,, |
| Best Best | 9 | 5 | 0 | ,, |
| Treble Best | 10 | 5 | 0 | ,, |
| Plates | 7 | 10 | 0 | ,, |
| Best Plates | 8 | 0 | 0 | ,, |
| ,, Boiler Plates | 8 | 10 | 0 | ,, |
| ,, Best Boiler Plates | 9 | 10 | 0 | ,, |
| Treble Best Boiler Plates | 12 | 0 | 0 | ,, |

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

## WALES.

**Cordes (Dos Works), Ltd., of Newport, Mon.,** quote "Star" brand patent wrought nails, steel nails, &c.

### Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

**Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla,** quote:—

| | Per Box. f.o.b. Wales. £ | s. | d. |
|---|---|---|---|
| **Coke Tin-plates.** | | | |
| C 18¾ by 14 124s. 110 lb. "BV" | 0 | 12 | 0 |
| C 20 by 10 225s. 155 ,, "Jumbo" | 0 | 17 | 0 |
| C 20 by 14 112s. 108 ,, "Lydbrook" | 0 | 11 | 9 |
| C 28 by 20 112s. 216 ,, "Lydbrook" | 1 | 3 | 9 |
| **Charcoal Tinplates:** | | | |
| C 20 by 14 112s. 108 lb. "Allaway" | 0 | 12 | 6 |

## BELGIUM.

**C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C.,** quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

| **Steel:** | £ | s. | d | |
|---|---|---|---|---|
| Blooms | at 3 | 12 | 0 | per ton. |
| Billets | at 3 | 14 | 0 | ,, |
| Sheet Bars | at 3 | 16 | 0 | ,, |
| **Finished Steel:** | | | | |
| Bars | at 5 | 0 | 0 | per ton. |
| Angles | at 5 | 1 | 0 | ,, |
| Tees | at 5 | 4 | 0 | ,, |
| Joists | at 4 | 10 | 0 | ,, |
| Fencing Standards | at 5 | 2 | 0 | ,, |
| Shoeing Bars | at 5 | 4 | 0 | ,, |
| Tyre Bars | at 5 | 4 | 0 | ,, |
| Half-Round Bars | at 5 | 5 | 0 | ,, |
| Heavy Rails | at 4 | 15 | 0 | ,, |
| Light Rails | at 4 | 17 | 6 | ,, |

**Structural Steelwork:**

Prices on application.

# METALS.

**Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool,** quote:—

## TIN.

| **Tin:** | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| English Ingots, f.o.b. Dis. 1¼% & 1% | 135 | 10 | 0 | to | 136 | 0 | 0 | per ton. |
| English Bars, f.o.b. Dis. 1¼% & 1% | 136 | 10 | 0 | to | 137 | 0 | 0 | ,, |
| Straits G.M.B., cash Warehouse, Net | 135 | 15 | 0 | to | 135 | 17 | 6 | ,, |
| Straits G.M.B., 3 months, Warehouse, Net | 134 | 10 | 0 | to | 134 | 12 | 6 | ,, |
| Australian, Mt. Bischoff, Warehouse, Net | 135 | 10 | 0 | to | 136 | 10 | 0 | ,, |

## COPPER.

| **Copper:** | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| Standard G.M.B., cash Warehouse, Net | 68 | 7 | 6 | to | 68 | 10 | 0 | per ton. |
| Standard G.M.B., 3 months, Warehouse, Net | 68 | 13 | 9 | to | 68 | 15 | 0 | ,, |
| English, Tough, Cake & Ingot, Warehouses, Net | 71 | 5 | 0 | to | 71 | 15 | 0 | ,, |
| English, Best Select, Warehouse Net | 72 | 10 | 0 | to | 73 | 0 | 0 | ,, |
| English, Sheets and Sheathing, f.o.b., Dis. 2½% | 82 | 0 | 0 | to | 82 | 10 | 0 | ,, |
| English Sheets for India, f.o.b., Dis. 2½% | 76 | 0 | 0 | to | 76 | 10 | 0 | ,, |
| Electro, Warehouse, Net | 70 | 15 | 0 | to | 71 | 0 | 0 | ,, |
| Ore, ex. ship | 0 | 12 | 0 | to | 0 | 13 | 0 | per unit |
| Regulus, Matte and Precipitate, ex. ship, | 0 | 13 | 3 | to | 0 | 14 | 0 | ,, |

## YELLOW METAL.

| **Yellow Metal:** | £ | s. | d. | £ | s. | d. | |
|---|---|---|---|---|---|---|---|
| Sheets, 4 by 4 feet for India f.o.b. Dis. 2½% | 0 | 0 | 6 3/8 | | | | per lb. |
| Sheathing ,, ,, | 0 | 0 | 6 7/8 | | | | ,, |

## SPELTER.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **Silesian** outports, Net | 23 | 7 | 6 | to | 23 | 10 | 0 | per ton |
| **Blende** of 50% Net | 6 | 11 | 6 | to | 6 | 15 | 0 | ,, |
| **Calamine**, Net | 6 | 14 | 0 | to | 6 | 15 | 0 | ,, |

## LEAD.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **English Pig**, Warehouse, Dis. 2½% | 12 | 15 | 0 | to | 12 | 17 | 6 | per ton. |
| **Spanish**, ex ship, Dis. 2½% | 12 | 8 | 9 | to | 12 | 10 | 0 | ,, |
| **Lead Ore** of 70%, Net | 6 | 2 | 6 | to | -- | | | ,, |

## ANTIMONY.

| | £ | s. | d. | | £ | s. | d. | |
|---|---|---|---|---|---|---|---|---|
| **Star Regulus**, f.o.b, Dis. 2½% | 35 | 0 | 0 | to | 36 | 0 | 0 | per ton. |
| **Ore**, 50%, ex ship, Dis. 2½% | 8 | 10 | 0 | to | 9 | 10 | 0 | ,, |
| **Crude**, ex ship, Dis. 2½% | 15 | 0 | 0 | to | 17 | 10 | 0 | ,, |

## QUICKSILVER.

| | £ | s. | d. | |
|---|---|---|---|---|
| **Spanish**, 75 lb., Warehouse, Net | 7 | 12 | 6 | per flask. |
| **Italian** ,, ,, ,, | 7 | 11 | 6 | ,, |

# COAL.

## LEICESTERSHIRE.

**The Nailstone Colliery Company, Leicester,** quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

**Upper Main Seam.**

| | s. | d. |
|---|---|---|
| Main Coal | 7 | 6 |
| Best Hard Steam (hand picked, as used by the Railway Companies) | 6 | 0 |
| Best Hard Steam Cobbles (made through 6 in. mesh, free from slack) | 6 | 0 |
| Fine Slack | 0 | 6 |

Terms, net cash on 10th of month following delivery.

## DERBYSHIRE.

**The Manners Colliery Co., Ltd., of Ilkeston** quote as follows, per ton at pit:

**Kilburn Coal:**

| | s. | d. |
|---|---|---|
| Best London Brights | 9 | 9 |
| Large Nuts (1¼ to 3¼) | 9 | 6 |
| Small Nuts (¾ to 1¼) | 6 | 0 |
| Rough Brights | 6 | 0 |
| Peas (⅝ to ¾) | 5 | 0 |
| Slack | 3 | 6 |
| Smudge | 2 | 0 |

**Low Main (or Tupton) Coal:**

| | | |
|---|---|---|
| Low Main Brights | 7 | 6 |
| ,, ,, Nuts | 7 | 3 |
| Hards (Good Steam Coal) | 8 | 0 |
| Bakers' Nuts (1" to 2") | 6 | 6 |
| Slack | 3 | 6 |

**The Clay Cross Company's Collieries, Clay Cross, near Chesterfield,** quote:—

| | per ton at pit. s. | d. |
|---|---|---|
| Best Main Coal | 10 | 6 |
| Best Silkstone | 10 | 0 |
| Best House Coal | 8 | 6 |
| Best House Nuts | 8 | 0 |
| Treble Screened Cobbles | 7 | 9 |
| Best Cobbles | 7 | 3 |

## NOTTINGHAMSHIRE.

**The Digby Colliery Co., Ltd., near Nottingham,** quote per ton at pit :—

**Digby Coal:**

| Steam. | s. | d. |
|---|---|---|
| Best Hand Picked Hard | 9 | 0 |
| Steam Hard | 7 | 9 |
| Hard Nuts | 7 | 0 |

**Gedling Colliery.**

High Hazel.

| | | |
|---|---|---|
| London Brights, 4 to 8 in. cube | 12 | 0 |
| Large Nuts, 2 to 4 in. cube | 9 | 6 |
| Small Nuts, ¾ to 2 in. cube | 5 | 6 |

Steam.—Top Hard.

| | | |
|---|---|---|
| Best Hard | 9 | 0 |
| Hard Steam | 8 | 0 |
| Cobbles | 7 | 0 |

# CHEMICALS AND OILS.

## CHEMICALS.

**Messrs. S. W. Royse and Co., Albert Square, Manchester,** quote:

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Acids:** | Oxalic | 0 | 0 | 2½ | per lb. |
| | Picric, Crystals | 0 | 0 | 11 | ,, |
| | Tartaric ..... at Manchester | 0 | 0 | 10⅞ | ,, |
| **Acetate of Lime:** | Brown at Manchester net | 9 | 10 | 0 | per ton. |
| | Grey ,, | 11 | 10 | 0 | ,, |
| **Alumina:** | Alum, Lump, loose | 5 | 5 | 0 | ,, |
| | ,, ,, in casks | 5 | 7 | 6 | ,, |
| | ,, Ground, in bags | 5 | 15 | 0 | ,, |
| | Sulphate of Alumina, 14% | 4 | 10 | 0 | ,, |
| **Ammonia:** | Carbonate | 0 | 0 | 3⅝ | per lb. |
| | Muriate Grey f.o.b. Liverpool | 24 | 0 | 0 | per ton. |
| | Sal-ammoniac, Lump, 1sts, deld. U.K. | 42 | 0 | 0 | ,, |
| | ,, ,, 2nds, ,, | 40 | 0 | 0 | ,, |
| | Sulphate f.o.b. Liverpool | 12 | 15 | 0 | ,, |
| **Arsenic:** | Best White Powdered net | 12 | 7 | 6 | ,, |
| **Bleaching Powder,** 35% ,, | | 4 | 10 | 0 | ,, |
| **Borax:** | British Refined Crystal ,, | 12 | 0 | 0 | ,, |

**Coal Tar Products:**

| | | | | | |
|---|---|---|---|---|---|
| Benzole, 50/90 % ,, | 0 | 0 | 6 | per gal. | |
| ,, 90% ,, | 0 | 0 | 7 | ,, | |
| Carbolic Acid Crystals, 34/35° C. ,, | 0 | 0 | 6 | per lb. | |
| ,, ,, ,, 39/40° C. ,, | 0 | 0 | 6¼ | ,, | |
| ,, ,, Liquid, 97/99 % ,, | 0 | 0 | 9 | per gal. | |
| ,, ,, Crude, 62½% at 60° F. f.o.b. ,, | 0 | 1 | 9 | ,, | |
| Creosote, ordinary good liquid ,, | 0 | 0 | 1⅝ | ,, | |
| Naphtha, Crude, 20 % at 120° C. ,, | 0 | 0 | 3 | ,, | |
| ,, Solvent, 90% at 160° C. f.o.b ,, | 0 | 0 | 8 | ,, | |
| ,, ,, 95 % at 160° C. ,, ,, | 0 | 0 | 9 | ,, | |
| ,, ,, 90 % at 190° C. ,, ,, | 0 | 0 | 10 | ,, | |
| ,, Rectified, flash point over 73° F. f.o.b. ,, | 0 | 0 | 11 | ,, | |
| ,, Rectified, flash point over 100° F. f.o.b. ,, | | 1 | 0 | ,, | |
| Naphthalene, all qualities. | | | | | |
| Pitch f.a.s. Manchester. ,, | 1 | 11 | 6 | per ton. | |
| **Copperas:** Green, in bulk ,, | 0 | 12 | 6 | ,, | |
| ,, barrels f.o.b. L'pool ,, | 1 | 19 | 0 | ,, | |
| Cake ,, | 1 | 2 | 6 | ,, | |
| **Copper:** Sulphate | 22 | 0 | 0 | ,, | |
| **Cyanides:** 98% minimum f.o.b. net | 0 | 0 | 7½ | per lb. | |
| **Lead:** Acetate (Sugar) White, English | 27 | 10 | 0 | per ton. | |
| ,, ,, ,, Foreign c.i.f. U.K | 24 | 5 | 0 | ,, | |
| ,, ,, Grey | 21 | 15 | 0 | ,, | |
| ,, ,, Brown at Manchester | 17 | 0 | 0 | ,, | |
| Nitrate | 24 | 0 | 0 | ,, | |
| Litharge, Flake | 15 | 10 | 0 | ,, | |
| ,, Powder | 16 | 0 | 0 | ,, | |
| Red Lead, Genuine, c.i.f. London less 5% | 15 | 10 | 0 | ,, | |
| White ,, ,, Dry ,, ,, ,, | 16 | 15 | 0 | ,, | |
| **Naphtha (Wood):** Miscible, 60 o.p. | 0 | 2 | 10 | per gal. | |
| Solvent | 0 | 2 | 7 | ,, | |
| **Potash:** Bichromate... delivered England | 0 | 0 | 3 | per lb. | |
| Carbonate, 90/92 % ... c.i.f Hull | 18 | 10 | 0 | per ton. | |
| Caustic, 75/80 % ,, ,, | 20 | 15 | 0 | ,, | |
| Chlorate net | 0 | 0 | 3 1/16 | per lb. | |
| Montreal in Store, Liverpool | 35 | 0 | 0 | per ton. | |
| Prussiate, Yellow net | 0 | 0 | 5 | per lb. | |

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Soda:** | Ash, Caustic, 48 %, Ordinary .. net | 5 | 5 | 0 | per ton. |
| | ,, ,, ,, Refined..... ,, | 6 | 5 | 0 | ,, |
| | ,, Carbonated, 48 %..... ,, | 5 | 10 | 0 | ,, |
| | ,, ,, 58 % (Ammonia Alkali) .....net | 4 | 10 | 0 | ,, |
| | ,, Bleachers' Refined Caustic 50/52 % .....net | 6 | 10 | 0 | ,, |
| | Caustic, White, 77 %..... ,, | 10 | 10 | 0 | ,, |
| | ,, ,, 70 %..... ,, | 9 | 12 | 6 | ,, |
| | ,, ,, 60 %..... ,, | 8 | 12 | 6 | ,, |
| | ,, Cream, 60 %..... ..... ,, | 8 | 10 | 0 | ,, |
| | Crystals, in bags ..... | 3 | 0 | 0 | ,, |
| | ,, barrels ..... | 3 | 7 | 6 | ,, |
| | Acetate ..... c.i.f. Hull net | 17 | 10 | 0 | ,, |
| | Bicarbonate, in 1 cwt. kegs..... | 6 | 15 | 0 | ,, |
| | Bichromate.....delivered England... | 0 | 0 | 2¼ | per lb. |
| | Chlorate ..... net | 0 | 0 | 3 1/16 | per lb. |
| | Nitrate...ex quay Liverpool, ... ,, | 11 | 7 | 6 | per ton. |
| | Phosphate ..... | 9 | 5 | 0 | ,, |
| | Prussiate .....net | 0 | 0 | 3⅝ | per lb. |
| | Silicate, Solution, 140° Tw. ... ... | 4 | 10 | 0 | per ton. |
| | Sulphate (Glauber Salts)..... | 1 | 12 | 6 | ,, |
| | ,, (Saltcake, 95%)..... | 1 | 15 | 0 | ,, |
| **Sulphur:** | Recovered ..... | 4 | 15 | 0 | ,, |
| | Roll ..... | 6 | 15 | 0 | ,, |
| | Flowers..... | 7 | 10 | 0 | ,, |
| **Zinc:** | Sulphate ..... | 6 | 15 | 0 | ,, |

## MINERALS.

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Barytes:** | Lump Carbonate, 90/92% ..... | 3 | 10 | 0 | per ton. |
| | Sulphate, No. 1, White ..... | 2 | 15 | 0 | ,, |
| **China Clay:** | of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid. | | | | |
| **Chrome Ore:** | Basis 50% c.i.f. British Ports..... ..... ... | 3 | 7 | 6 | ,, |
| **Manganese:** | Lump c.i.f. Liverpool 10½d. | per metallic unit. | | | |
| **Ochre:** | French JC ..... f.o.b. Rouen, net | 2 | 5 | 0 | per ton. |
| | ,, JF ..... | 5 | 10 | 0 | ,, |
| **Talc:** | (French Chalk).....c.i.f. Liverpool | 3 | 10 | 0 | ,, |

## OILS, etc.

| | | £ | s. | d. | |
|---|---|---|---|---|---|
| **Aniline Oil** | .....net | 0 | 0 | 4½ | per lb. |
| ,, **Salt** | ..... ..... ..... ,, | 0 | 0 | 4½ | ,, |
| **Castor Oil:** | French, 1st pressure, f.o.b. Marseilles less 1¼%..... | 22 | 15 | 0 | per ton. |
| | English, 1st pressure, f.o.r. Hull, less 2½%..... | 23 | 5 | 0 | ,, |
| **Cocoa Nut Oil:** | Ceylon, ex store Manchester.....net | 29 | 10 | 0 | ,, |
| | Cochin, ex store Manchester. .....net | 32 | 0 | 0 | ,, |
| **Cotton Seed Oil:** | Refined at Hull, less 2½% naked ..... | 13 | 15 | 0 | ,, |
| | Edible...at Hull, less 2½% naked ..... | 14 | 5 | 0 | ,, |
| **Glycerine:** | Crude, 80% ..... ... net | 31 | 0 | 0 | ,, |
| **Linseed Oil:** | Raw... ..at Hull, less 2½% naked .. ..... | 14 | 5 | 0 | ,, |
| | Boiled.....at Hull less 2½% naked ..... ..... | 15 | 5 | 0 | ,, |
| **Starch:** | American Pearl...at Manchester, net | 8 | 15 | 0 | ,, |
| | Dextrine..... ,, ,, | 17 | 15 | 0 | ,, |
| | Farina..... ,, ,, | 15 | 0 | 0 | ,, |
| **Shellac:** | Standard TN orange spot ..... | 147/- | | | per cwt. |
| **Turpentine:** | American.....at Liverpool | 38 | 0 | 0 | per ton. |
| | Russian .....at Hull...net | 19 | 0 | 0 | ,, |

# TIMBER.

**Messrs. Alfred Dobell and Co., Liverpool,** quote:—

## COLONIAL WOODS.

### Timber.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Quebec Square White Pine... | per cub. ft. | 0 | 1 | 9 | to 0 | 3 | 0 | |
| Quebec Waney Board Pine... | ,, | 0 | 2 | 8 | 0 | 3 | 9 | |
| St. John Pine, 18 in. average | ,, | 0 | 2 | 4 | 0 | 3 | 3 | |
| Lower Ports Pine..... | ,, | 0 | 1 | 3 | 0 | 1 | 8 | |
| Quebec Red Pine ..... | ,, | 0 | 1 | 6 | 0 | 2 | 0 | |
| Quebec Oak, 1st quality ..... | ,, | 0 | 2 | 9 | 0 | 3 | 4 | |
| Quebec Oak, 2nd quality ... | ,, | 0 | 1 | 6 | 0 | 2 | 6 | |
| Ash ..... ..... | ,, | 0 | 1 | 6 | 0 | 2 | 3 | |
| Elm .. ..... | ,, | 0 | 3 | 3 | 0 | 3 | 10 | |
| Hickory ..... | ,, | 0 | 2 | 0 | 0 | 2 | 6 | |
| Quebec Birch ..... | ,, | 0 | 1 | 6 | 0 | 2 | 3 | |
| St. John Birch..... ..... | ,, | 0 | 1 | 6 | 0 | 2 | 0 | |
| Birch Planks..... | ,, | 0 | 0 | 9 | 0 | 0 | 11 | |
| Spruce Spars ..... | ,, | 0 | 0 | 10 | 0 | 1 | 0 | |

### Deals.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| 1st quality Quebec Pine ..... | per std. | 22 | 10 | 0 | to 32 | 10 | 0 | |
| 2nd do. do. ..... | ,, | 17 | 0 | 0 | 22 | 0 | 0 | |
| 3rd do. do ..... | ,, | 11 | 10 | 0 | 13 | 0 | 0 | |
| St. John, N.B., etc., Spruce | ,, | 6 | 15 | 0 | 7 | 5 | 0 | |
| Lower Ports Spruce.. .. ..... | ,, | 6 | 10 | 0 | 6 | 15 | 0 | |
| **Spruce Boards**..... | ,, | 5 | 10 | 0 | 6 | 0 | 0 | |

## UNITED STATES, etc., WOODS.

### Pitch Pine.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Hewn ..... | per cub. ft. | 0 | 1 | 4 | to 0 | 1 | 8 | |
| Sawn ..... ..... ..... | ,, | 0 | 0 | 11 | 0 | 1 | 6 | |
| Planks, Stowage ..... | ,, | 0 | 0 | 10 | 0 | 1 | 0 | |
| Boards, Prime ..... | per std. | 12 | 10 | 0 | 16 | 0 | 0 | |
| **Oak Timber** .. ..... . ... | per cub. ft. | 0 | 1 | 6 | 0 | 2 | 6 | |
| **Oak Planks** ..... ..... | ,, | 0 | 1 | 6 | 0 | 2 | 1 | |
| **East India Teak**..... | per load | 12 | 0 | 0 | 16 | 0 | 0 | |
| **Greenheart**..... ..... | ,, | 6 | 15 | 0 | 7 | 10 | 0 | |

## EUROPEAN WOODS.

### Timber.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Riga Redwood ..... | per cub. ft. | 0 | 1 | 6 | to 0 | 2 | 0 | |
| Dantzic and Memel Fir, Crown ..... ..... | ,, | 0 | 2 | 1 | 0 | 2 | 6 | |
| Dantzic and Memel Fir, Middling ..... ..... | ,, | 0 | 1 | 9 | 0 | 1 | 11 | |
| Stettin ..... .. ..... | ,, | 0 | 1 | 9 | 0 | 1 | 11 | |
| Swedish..... ..... ... | ,, | 0 | 1 | 0 | 0 | 1 | 3 | |
| Riga Whitewood . ..... ..... | ,, | 0 | 1 | 0 | 0 | 1 | 3 | |
| Norway Mining Timber ... .. | ,, | 0 | 0 | 9 | 0 | 1 | 0 | |
| Dantzic and Stettin, etc., Oak.. ..... | ,, | 0 | 2 | 6 | 0 | 3 | 0 | |
| **Norway Spars**..... | ,, | 0 | 1 | 2 | 0 | 1 | 9 | |

### Deals.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Red Archangel and Onega, 1st quality ..... | per std. | 19 | 0 | 0 | 20 | 0 | 0 | |
| Red Archangel and Onega, 2nd quality .. ..... | ,, | 14 | 0 | 0 | 16 | 0 | 0 | |
| Red Archangel and Onega, 3rd quality ..... | ,, | 10 | 10 | 0 | 12 | 10 | 0 | |
| St. Petersburg, 1st quality... | ,, | 16 | 0 | 0 | 17 | 10 | 0 | |
| Do. 2nd ,, ... | ,, | 14 | 0 | 0 | 15 | 0 | 0 | |
| Gefle ..... | ,, | 11 | 10 | 0 | 16 | 0 | 0 | |
| Wyburg ..... | ,, | 11 | 0 | 0 | 12 | 10 | 0 | |
| Uleaborg ..... | ,, | 10 | 0 | 0 | 12 | 10 | 0 | |
| Gothenburg ..... | ,, | 11 | 0 | 0 | 16 | 0 | 0 | |

# SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.*

## NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

**4581. A. M. Todd and E. Williams, North Wales.** Mar. 6th.—Improvements in stop valves and the like.

**4589. H. Monk, Chester.** Mar. 6th.—Improvements in epicyclic gearing.

**4595. T. R. Charlton and G. H. Tarver, Newcastle.** Mar. 6th.—Improvements in stopping and starting hydraulic pumps, electrically driven or otherwise.

**4596. L. Carr, New Cleethorpes.** Mar. 6th. A double-shackle swivel.

**4598. D. F. Taylor and Co., Ltd., and F. Carter, Birmingham.** Mar. 6th.—Improvements in ties or connections for driving belts, bands and ropes.

**4599. H. Skelton, Stockton-on-Tees.** Mar. 6th.—Improved means or apparatus for flushing sewers, also adapted for drawing off storm water.

**4603. L. Wilson, Scotland.** Mar. 6th.—Improvements in elastic fluid motors (turbines).

**4604. L. F. Massey and H. F. Massey, Manchester.** Mar. 6th.—Improvements in pneumatic power hammers.

**4606. J. Baeder, Germany.** Mar. 6th.—Improvements in change speed stop gears.

**4609. E. Lange, Germany.** Mar. 6th.—Improvements in rotary engines.

**4615. G. McGhee, Glasgow.** Mar. 6th.—Improved variable speed and reversing gear.

**4620. F. B. Wells, London.** Mar. 6th.—Improved drilling appliance adapted for use in substitution for a ratchet brace.

**4623. W. Anstey, Charlton.** Mar. 6th. A mixing valve for supplying cold, tepid or hot water to baths or other receptable.

**4633. O. O. Storle, London.** Mar. 6th.—Improvements in or relating to valves.

**4645. R. M. Deeley, London,** Mar. 6th.—Improvements relating to the working of compound engines and in regulator valves therefor.

**4653. J. Cowan, London.** Mar. 6th.—Improvements relating to separately fired superheaters.

**4656. J. E. Mathewson, London.** Mar. 6th.—Improvements in apparatus for drying sand moulds in foundries.

**4657. N. J. Hennemann, London.** Mar. 6th.—Improvements in and relating to supplying and controlling the feed-water of steam generators.

**4659. E. J. Mead, London.** Mar. 6th.—Improvements in and connected with rotary pumps.

**4674. H. E. Newton, London.** Mar. 6th.—Improvements in centrifugal, turbine and similar pumps. (*H. R. Worthington, U.S.A.*)

**4692. H. B. Barlow, Manchester.** Mar. 7th.—Improvements in steam and other fluid pressure regulators. (*Foster Engineering Company, U.S.A.*)

**4707. H. T. Boothroyd, Liverpool.** Mar. 7th.—Improvements in portable drilling apparatus.

**4712. D. F. Stayman and G. T. Phillips, London.** Mar. 7th.—Improvements in pistons and piston valves.

**4718. A. B. Snell and G. Candelet, London.** Mar. 7th.—Improvements in and relating to the construction of ships' hulls.

**4721. C. von Bergmann, Germany.** Mar. 7th.—Improvements in and relating to self-acting boiler-feeders.

**4749. A. P. Filippi, London.** Mar. 7th.—Improvements in propellers. (Date applied for Mar. 7th, 1904.)

**4784. W. A. P. Werner, London.** Mar. 7th.—Improvements in and relating to steam generators and in and relating to burners more especially applicable to steam generators.

**4785. W. A. P. Werner, London.** Mar. 7th.—Improvements in and relating to automatically operating mechanism for the regulation of the feed-water supply to steam generators and the like.

**4789. J. Douglas, London.** Mar. 7th.—Improvements in reversible and feathering screw propellers

**4804. R. R. Neilson, Glasgow.** Mar. 8th.—Improvements in steam generators.

**4840. J. Noad, London.** Mar. 8th.—Improvements in the manufacture of metallic hollow cylindrical or tubular bodies.

**4844. J. W. Haywood, Leeds.** Mar. 8th.—Mechanical enclosed airtight damper for boilers and chimneys.

**4871. W. O. Wood, London.** Mar. 8th.—Improvements relating to the sinking of shafts or the formation of tunnels in aqueous strata and similar unstable material.

**4886. De Courcy Beamish, Liverpool.** Mar. 8th.—Improvements in or in connection with the steering of ships.

**4892. H. Chitty, London.** Mar. 8th.—Improvements relating to power generators.

**4910. S. B Halcomb, P. MacGregor and J. F. Bennett, Sheffield.** Mar. 9th.—Improvements in the treatment of metals for rolling drawing and other purposes.

**4919. H. Cottrell and J. Adkins, Hanley.** Mar. 9th.—Combined flue chimney top (to prevent down draught).

**4924. J. E. Preston, London.** Mar. 9th.—Improved rotary engine pump or compressor.

**4929. J. H. Lawrence, Neath.** Mar. 9th.—Graduated adjustable ball valve arrangement for flushing cisterns and water tanks (to regulate supply and prevent overflows).

**4932. J. Redman, T. Redman and E. S. Redman, Halifax.** Mar. 9.—An appliance for transferring a driving belt from one pulley on a speed cone to any other pulley on same cone.

**4940. C. B. Rearick, London.** Mar. 9th.—Improvements in and relating to steam generators.

**4943. T. J. Ridge, London.** Mar. 9th.—Improvements in differential gear.

**4946. A. Wilkins, Dovercourt.** Mar. 9th.—Improved screw propeller.

**4961. W. Rowland, London.** Mar. 9th.—Improvements in valve and reversing gear for steam engines and the like.

**4962. W. Rowland, London.** Mar. 9th.—Improvements in valve and reversing gear for steam engines and the like.

**4986. A. C. Potter, London.** Mar. 9th.—Improvements in and relating to means for ascertaining the depth from the surface of water in well borings and for similar purposes.

**4991. A. B. Chatwood, Manchester.** Mar. 10th.—Improvements in steam engine valves.

**4992. T. H. Barton, Little Eaton.** Mar. 10th.—An internally and centrally acting double expanding friction clutch for clutching the driving toothed wheels, chain wheels, belt pulleys and the like used in motors, bicycles or general machinery.

**4997. J. Carr, Glasgow.** Mar. 10th.—Improved means for obtaining motive power.

**4999. C. M. McNamara, Glasgow.** Mar. 10th.—Improvements relating to covered tipping dust and other carts.

**5004. J. H. Boylan, Manchester.** Mar. 10th.—Improvements in tubes for steam generators and steam superheaters and feed-water heaters.

**5009. J. R. Drysdale, Newcastle.** Mar. 10th.—Automatic motion.

**5011. J. N. Kay, Bury.** Mar. 10th.—Improvements in friction clutches for transmitting power.

**5021. R. R. Rook, Chapeltown.** Mar. 10th—Improvements in means or apparatus for propelling vessels.

**5031. E. Brinham, Stockton-on-Tees.** Mar 10th.—An improved mechanical and automatic arrangement for working the warping gear of steam trawling and other winches.

**5037. P. W. Noble, Coventry.** Mar. 10th.—Improvements in or relating to fluid pressure engines.

**5041. T. H. Stringer and A. Liwentaal, London.** Mar. 10th.—Improvements in and relating to motor launches and other navigable vessels.

**5043. J. E. Tolson, London.** Mar. 10th.—Improvements in rotary engines.

**5044. J. E. Tolson, London.** Mar. 10th.—Improvements in or relating to steam generators.

**5052. W. Reuter, London.** Mar. 10th.—Trough-charging travelling crane for Siemens-Martin furnaces.

**5055. C. H. T. Alston, London.** Mar. 10th.—An improved mechanical device for transmitting, retarding or accelerating, stopping and reversing the motion of shafts.

**5064. W. P. Reynolds, London.** Mar. 10th.—Improvements in and relating to reversing valve gear.

**5065. J. D. Loppentien, London.** Mar. 10th.—Improvements in and relating to power-transmitting devices.

**5074. J. M. Stratton, London.** Mar. 10th.—Improvements in or connected with the furnaces of steam boilers.

**5083. A. Elgar, London.** Mar. 10th.—Improvements in and connected with submarine torpedo-boats.

**5098. P. S. Swan, Glasgow.** Mar. 11th.—Improvements in flues or furnaces for steam boilers.

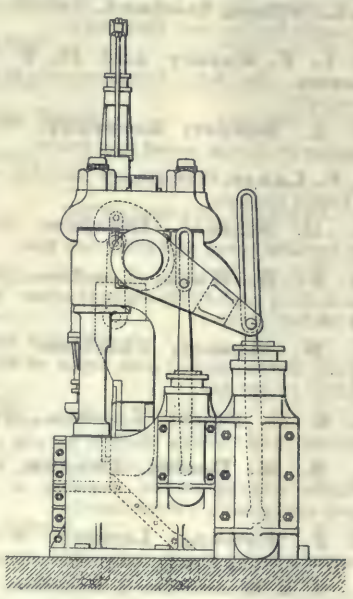
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## RECENT SPECIFICATIONS.

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### HYDRAULIC SHEARING PUNCHING AND FORGING MACHINES.

**A. Lamberton, of Coatbridge.** April 8th 1904.—Relates to hydraulic shearing, punching, forging, and the like machines, in which, as hitherto generally constructed, the power used to perform a working stroke is constant with different dimensions of work operated on, so that when work lighter than the maximum capacity

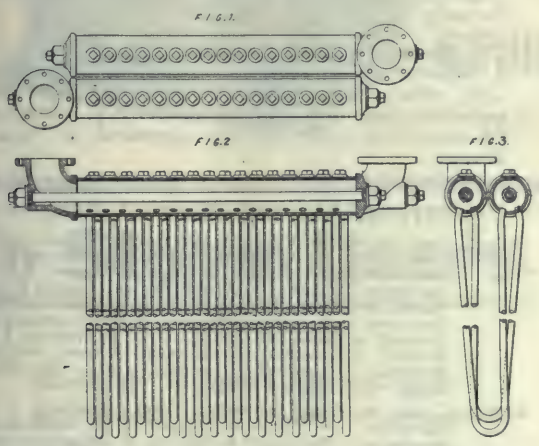


of the machine is being operated upon there is a considerable waste of power; and this invention has for its object to construct machines such that the power used may be proportioned to the work operated upon and in which, at the same time, there are no frictional losses due to the movements of idle parts when the machines are working below their maximum power. The essence

of the invention is the use, in shearing, punching, forging or similar machines, of a number of hydraulic operating rams any one of which, or a group of any two or more of which, may be utilised to operate the machine with power proportionate to the work to be done, while those not so used remain at rest, and the invention may be applied to machines other than that hereinbefore described by way of example, and in a manner differing therefrom without departing from its spirit; for example, any number of rams may be provided, and the means for permitting the non-operating rams to remain at rest may be of any convenient form.

## STEAM SUPERHEATERS.

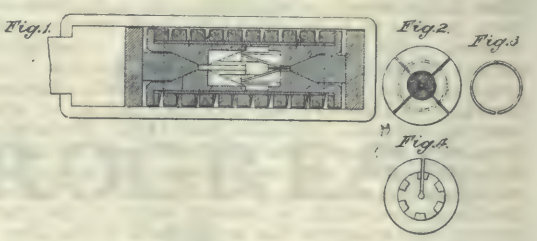
**F. Hargreaves and J. G. Hudson, of Bolton.** April 9th, 1904.—This invention relates to superheaters for steam, and has for its object by an improved combination and arrangement of parts to provide a superheater, which is of simple construction, easy to assemble, and readily accessible for overhaul or repair. According to one construction a straight inlet and a straight outlet header is provided, which may be either circular or of other convenient form in cross section, which are preferably formed with cylindrical parts at their ends. To these cylindrical parts are secured, by a single long bolt passing through the header, a right-angled outlet or inlet flanged branch pipe at the one end, and a blind flange at the other end; the outlet and inlet branches being thus capable of swivelling on the ends of the headers, so that the connection with the headers may be angled through a considerable arc. A series of




external bolts extending from end to end of the headers, and passing through flanges on the inlet and outlet branches, or also on the headers may be provided to additionally secure the parts together, or in place of the internal bolts. The two headers are arranged side by side with the inlet branch of the inlet header at the opposite end from the outlet branch of the outlet header, and from the headers there depends a series of more or less U-shaped tubes, the ends of the tubes being so set as to be radial to the points on the headers where they are entered. The ends of these tubes are expanded into a series of holes in each header; successive holes in each header being arranged on opposite sides of the centre of the bottom of the header, and pairs of holes in each header at the same side of the centre line being connected by each U-tube, so that the row of tubes when assembled are staggered, and so present a larger unobstructed surface to the hot gases, and offer more obstruction to their passage.

## RAILWAY BUFFING AND DRAW GEAR.

**G. Westinghouse, of Pennsylvania, U.S.A.** Jan. 8th 1904 (date claimed under International Convention).—This invention relates in general to combined spring and friction devices for yieldingly resisting strains and gradually absorbing shocks, and more particularly to that class of these appliances used as draw gear and buffing apparatus for railway cars. The principal object of this invention is to simplify such apparatus as is already in use by dispensing with certain parts, such as the rigid casing and the preliminary spring, and to provide a device in which the main resistance




spring itself acts as a casing for holding the enclosed friction members against transverse movement, thereby reducing the number of necessary parts and the cost of manufacture, while at the same time providing a compact, durable and efficient apparatus. Several different forms of gear are described and illustrated, and claim is made to the following: a draw gear or buffing apparatus comprising friction members having longitudinal frictional surfaces, a helical resistance spring surrounding the said friction members and forming a casing therefor, and a wedging device for forcing the members into frictional engagement.

## NEW DOCK FACILITIES.

As to the extensive system of wharves which has just been sanctioned by the Thames Conservancy Board, the Railway News states that this scheme has been originated by Mr. Ernest Forwood, a well-known shipowner. It appears that the wharf will be situated about midway along Long Reach, eighteen miles from London by rail and six miles above Gravesend, on a stretch of river about four miles in length, where the course of it is straight, and where there is ample water. The wharf is to be 6,600 ft., or 440 yards over a mile in length, and will be able to deal with six million tons of goods a year, and no less than twenty ships of 300 ft. long, and drawing any depth of water up to 30 ft., will be able to lie alongside at one time, while a hundred barges can have cargo transferred to them simultaneously. Between the embankment and the wharf there will be a large area of sheltered water in which barges can lie and be loaded either from the transport sheds, or from the vessels direct, long-armed cranes on the wharf lifting goods straight out of the holds of ships on the river side and depositing them in barges on the land side.

# NEW PUBLICATIONS.

## "MANUAL OF ELECTRICAL UNDERTAKINGS AND DIRECTORY OF OFFICIALS, 1905."

Compiled under the direction of Emile Garcke. Electrical Press, Ltd. 15s. net.

This indispensable auxiliary has how reached its ninth year of publication, and although the electrical industries were by no means exempt from last year's general depression in trade, the manual now before us shows a decided increase in bulk, which seems to reflect increasing activities in the various fields of electrical engineering. The arrangement of the statistics and other matter remains substantially in the same convenient form familiar to those who have used the preceding volumes. The general information is classified as follows: Electric Lighting, Power and Traction; Telegraph and Telephone; Manufacturing and Miscellaneous; Directory of Directors and Officials; and list of other electrical companies registered since 1856. All electrical companies and municipal electrical undertakings are included in these sections. Taking the returns as a whole, we find that they reveal the effects of the trade conditions from which no industry seems to have been exempt. An exception has to be made in the case of telegraphs and telephones, as in the one case the business is world-wide and less susceptible to local influences, while the telephone business in this country has a special vitality which effects steady progress while manufacturing and kindred interests are fluctuating. Thus the average return on the telegraph companies is 5·19 per cent., while in the previous volume the corresponding figure stood at 4·76 per cent. The telephone rate has likewise risen from 4·80 to 4·88 per cent.

In addition to the data regarding each undertaking, there is a section devoted to the chief electrical events of the past year, including the Royal Commission on London Locomotion, Tramway Running Powers, Electrification of Steam Railways, the Wireless Telegraphy Act and the agreement between the Marconi Companies and the Post Office, Municipal Telephones, the Supply of Electricity Bill, and the London Electric Lighting Areas Act. Other special contents of the "Manual" repeated in up-to-date form are the lists of highest and lowest prices of electrical investments, lists of all electrical railways, tramways, and light railways, and the elaborate schedule, now enlarged, which gives a complete analysis of the revenue accounts of electric supply undertakings. Although we cannot call attention to all the admirable features of the volume, mention must be made of the many valuable maps, which give a comprehensive idea of the progress of electric traction.

## "THE ELEMENTS OF RAILWAY ECONOMICS."

By W. M. Acworth. The Clarendon Press. 2s. net.

The object of this book, the author tells us, is to consider railways and railway business from the economic point of view. The need of such a work has often been felt, and it is a pity that Mr. Acworth, who has lectured on this subject for several years at the London School of Economics, has not carried out his work with a nearer approach to completeness; but his idea seems to have been that half a loaf is better than no bread; as he is eminently fitted for the authorship of a volume of greater utility, we shall look forward to its publication with much interest. The student, however, will no doubt find this little work very helpful. After a brief sketch of railway development, the writer discusses railway capital and expenditure, the maintenance of way, rolling stock and traffic, methods of charging, classification and rates and the interference of Parliament.

# BOOKS RECEIVED.

"The Investigations of Mine Air: an account, by several authors, of the nature, significance, and practical methods of measurement of the impurities met with in the air of Collieries and Metalliferous Mines." Edited by Sir Clement Le Neve Foster, D.Sc F.R.S, and J. S. Haldane, M.D., F.R.S. 6s. net.

"Applied Mechanics and Mechanical Engineering." By Andrew Jamieson, M.Inst.C.E. Charles Griffin and Co. 12s. 6d.

"Journal of the Institution of Electrical Engineers, including original communications on Telegraphy and Electrical Science." Edited by George C. Lloyd. E. and F. N. Spon. 5s.

"A Classbook of Naval Architecture." By W. J. Lovett. Longmans, Green and Co. 7s. 6d. net.

"Fire Tests with Glass: Electro-Glazed Cas ments." The British Fire Prevention Committee. 2s. 6d.

"Steam Turbines, with an appendix on Gas Turbines and the Future of Heat Engines." By Dr. A. Stodold, translated by Dr. Louis C Loewenstein. Archibald Constable. 21s. net.

# NEW CATALOGUES.

**A very attractive Pamphlet,** has been issued by Messrs. Ed. Bennis and Co., Ltd., on the "Bennis" Stoker and Compressed Air Furnace. The raison d'être of the pamphlet is summed up in the words, "Cheap Steam," which appear in metallic embossed lettering on the green cover. The details of the Bennis system are very carefully explained, and there are numerous illustrations, the most important being a double page view showing photo of Bennis Patent Stoking and complete Coal and Ash Elevating and Conveying Plant as fitted to eighteen boilers at the Carlton Main Colliery Company's (Ltd.) Grimethorpe Colliery, near Barnsley.

**"The Britisher's Black Diamond"** is the title of a booklet issued by Messrs. Graham, Morton and Co., Ltd., which pictorially describes the new coal screening plant at the Thrybergh Colliery, Kilnhurst, an account of which recently appeared in PAGE'S WEEKLY.

## *MEETINGS FOR THE ENSUING WEEK.*

FRIDAY, MAR. 24.—Physical Society, University College, Gower Street, 5 p.m.; 1. "Note on the Voltage Ratios of an Inverted Rotary Converter," by Mr. W. G. Clinton. 2. "On the Flux of Light from the Electric Arc with varying Power Supply," by Mr. G. B. Dyke. 3. "The Application of the Cymometer and the Determination of the Coefficient of Coupling of Oscillation Transformers," by Professor J. A. Fleming, F.R.S.—Electro Harmonic Smoker, Holborn Restaurant, 8 p.m.—Royal Institute, 9 p.m.: Sir Oliver Lodge, "A Pertinacious Current."

SATURDAY, MAR. 25.—Royal Institution, 3 p.m.: Professor J. J. Thompson on "Electrical Properties of Radio-Active Substances."—Manchester Association of Engineers, Grand Hotel, 7 p.m.: Paper, "Power Gas Plants and some of their uses; Mr. T. Rigby.

MONDAY, MAR. 27.—Royal Geographical Society, 8.30 p.m.: Sir Harry Johnston on "Liberia."—Society of Arts, 8 p.m.: Mr. H. Laws Webb on "Telephony," Lecture III.—Institute of Marine Engineers, Stratford, 8 p.m.: "Fuel Testing."

TUESDAY, MAR. 28.—Royal United Service Institution, 3 p.m.: Lieut.-General Sir J. French presides at a lecture by Major the Hon. T. F. Fremantle: Paper, "Modern Military Rifles."—Royal Institution, 5 p.m.: Professor W. E. Dalby: Paper, "Engineering Problems."—Society of Arts, 4.30 p.m.: The Agent-General for Western Australia: Paper, "The Manufactures of Greater Britain: II., Australasia."—Institution of Electrical Engineers, Manchester Local Section: Paper, "Use of Electric Energy in Mines and Collieries," Mr. W. D. Mountain.—Institute of Civil Engineers, Great George Street, W. 8 p.m.

WEDNESDAY, MAR. 29.—Chemical Society: Annual General Meeting, 4.30 p.m.—Dundee Institute of Engineers: Annual General Meeting.

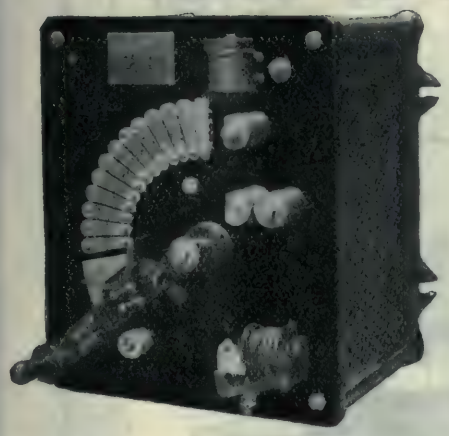
THURSDAY, MAR. 30.—Royal Society, 4.30 p.m.—Civil and Mechanical Engineers, 8 p.m.

FRIDAY, MAR. 31.—Royal Institution, 9 p.m.

PAGE'S WEEKLY — Miscellaneous


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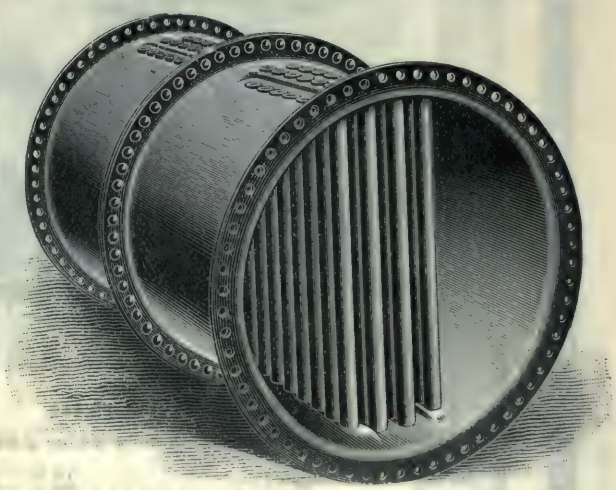
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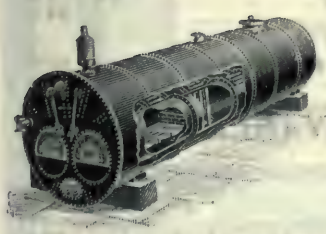
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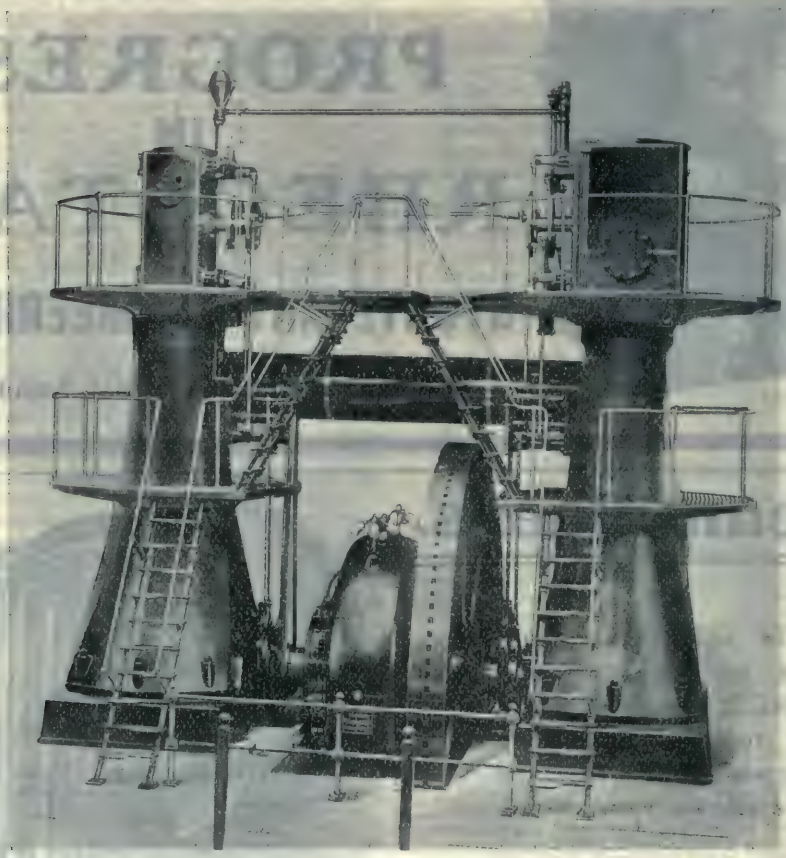
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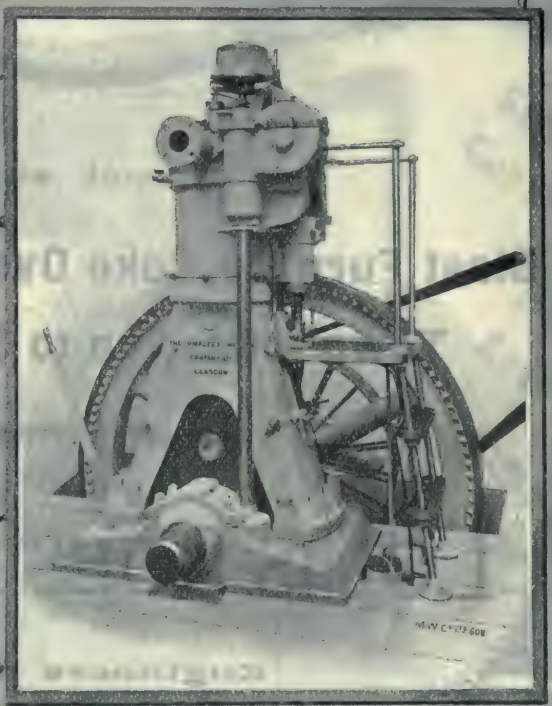
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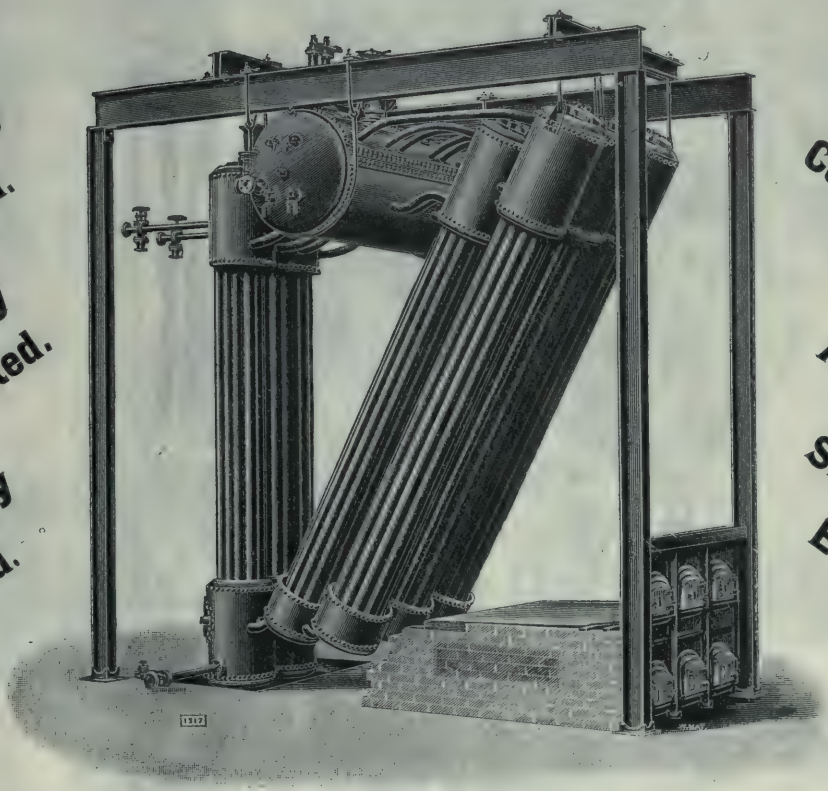
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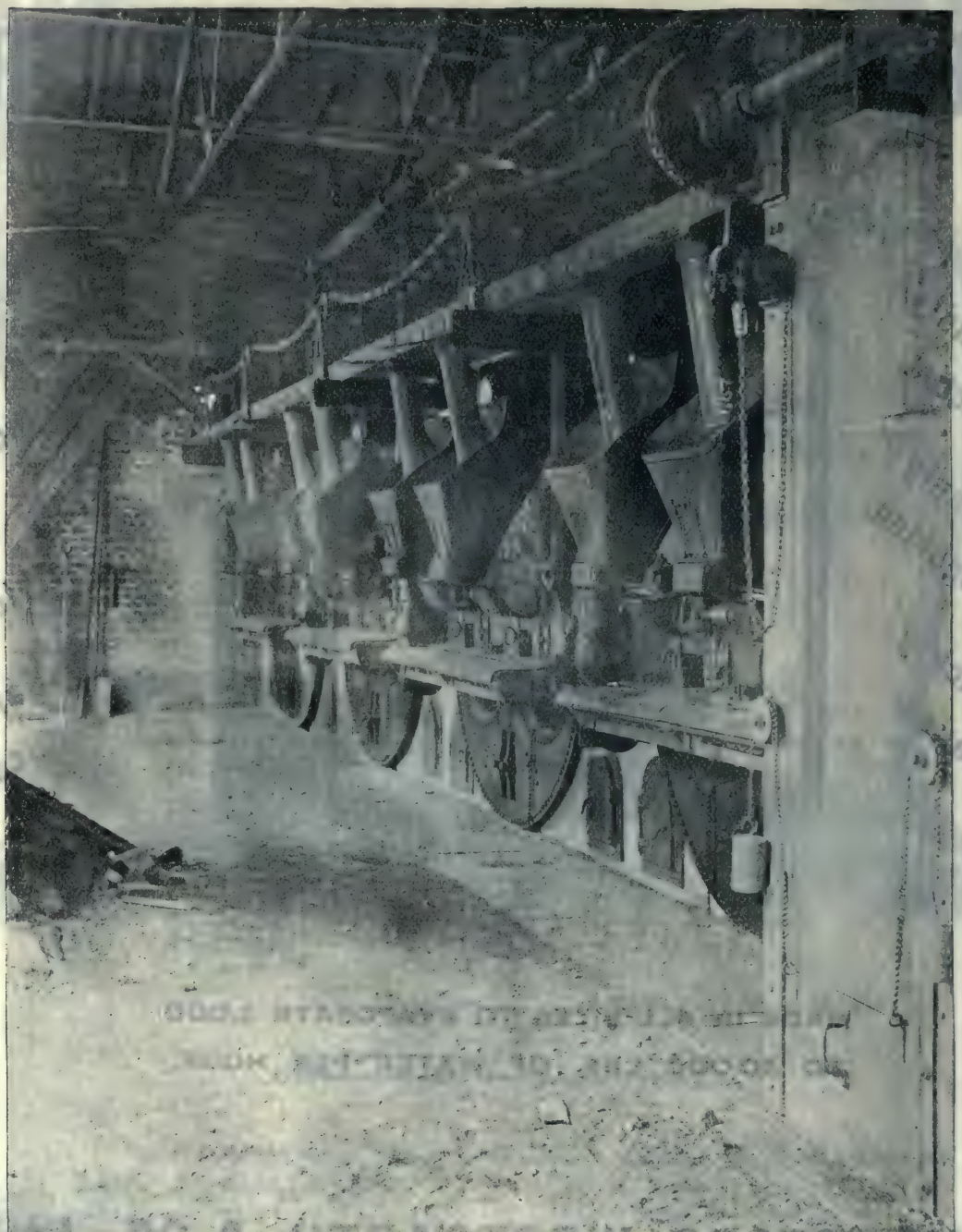
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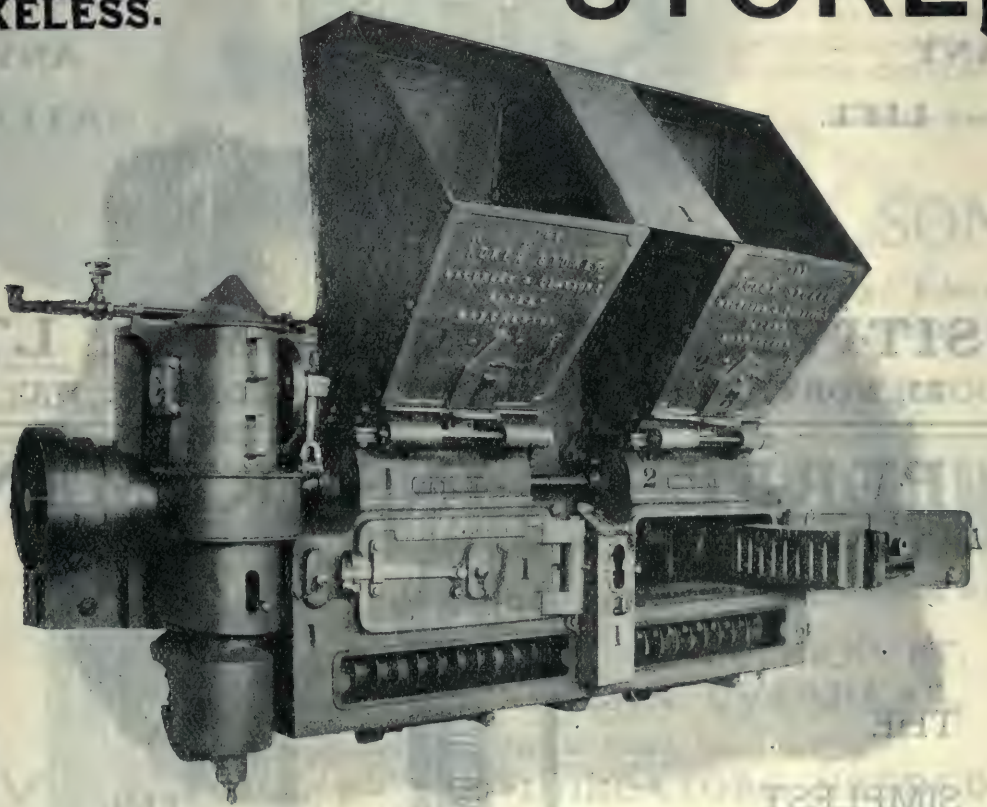
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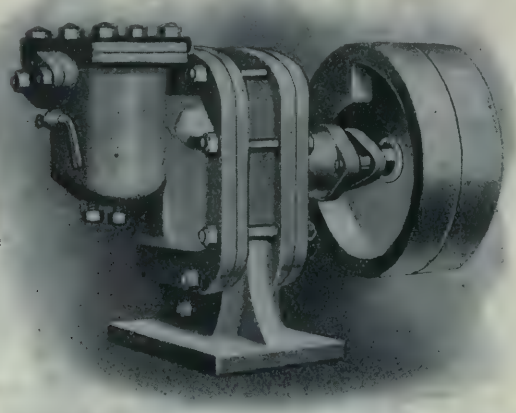
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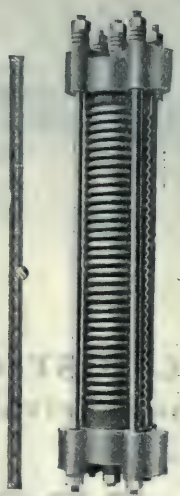
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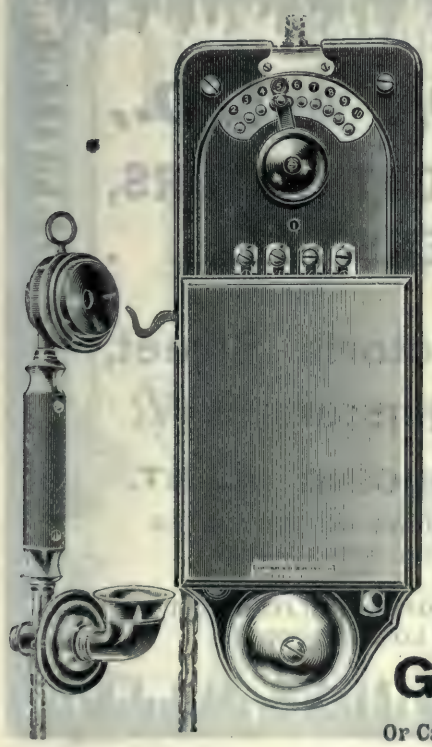
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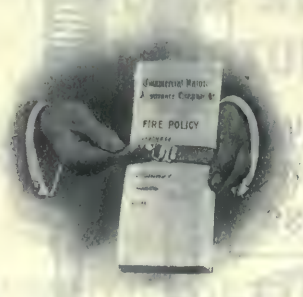




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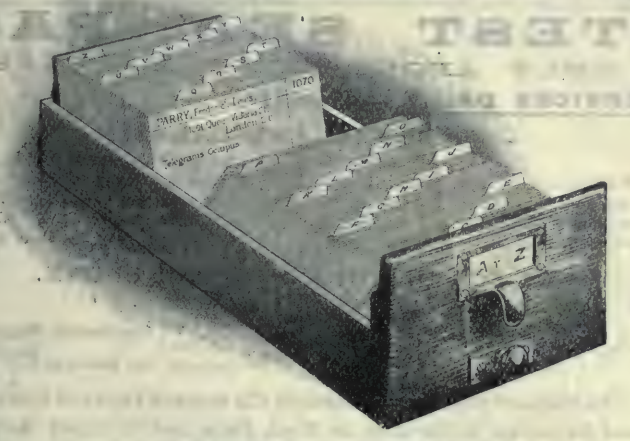
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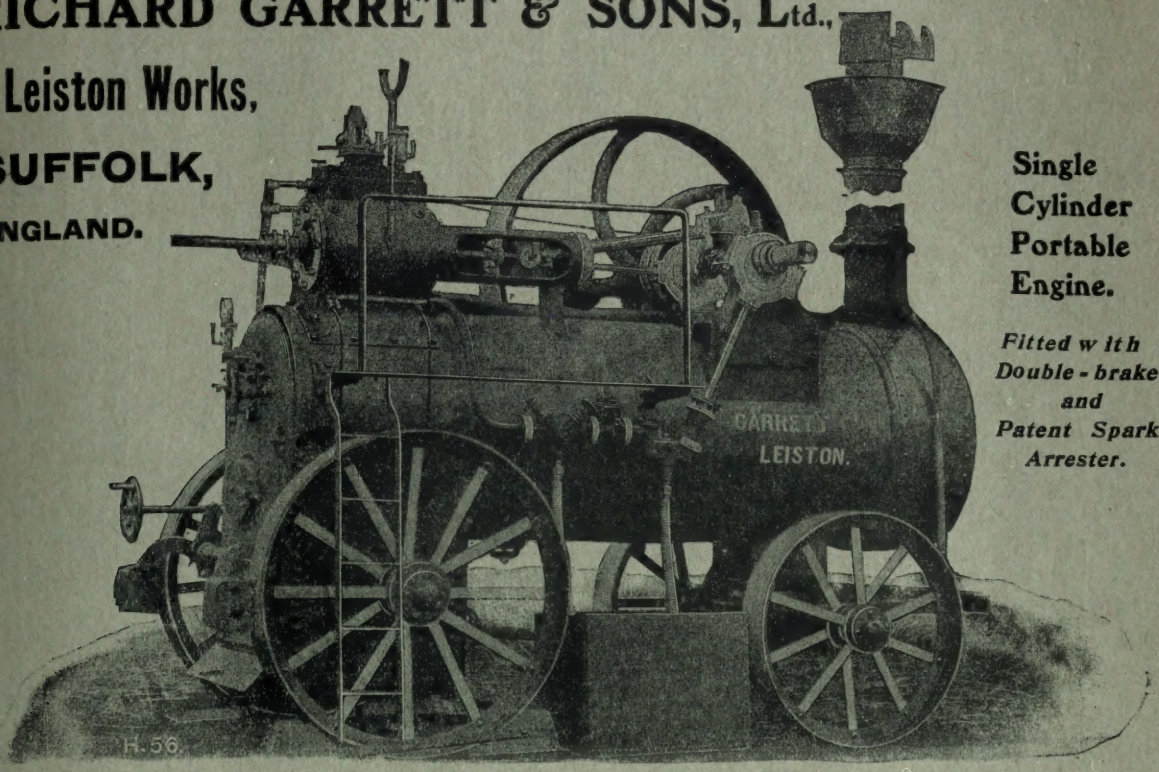
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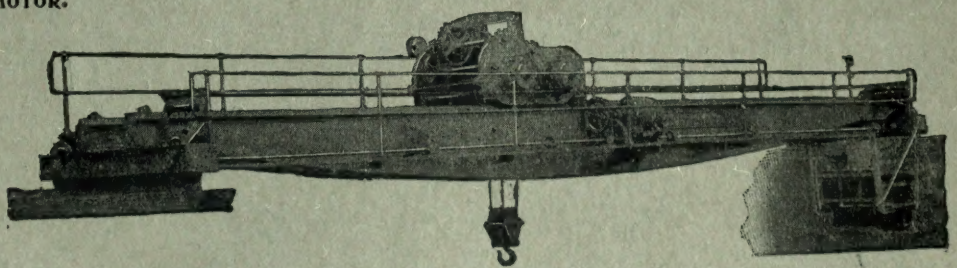
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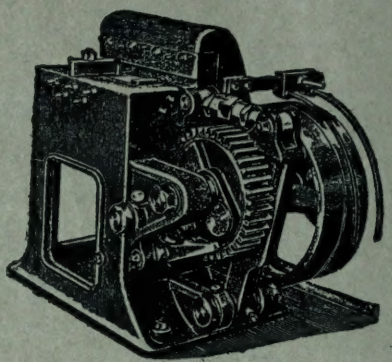
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